The New Zealand
Journal of Agriculture.

VOL. 47. WELLINGTON, 21ST AUGUST, 1933. No. 2.

THE RAPE CROP IN NEW ZEALAND.

TYPES, CHEMICAL COMPOSITION, UTILIZATION, AND SEED CERTIFICATION.

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IN this *Journal* for October, 1931, the writer described some preliminary observations on the types of rape used in New Zealand. Additional trials have now corroborated these and have added materially to our knowledge of the behaviour of the several types in the field and laboratory. The present discussion summarizes the observations on 120 commercial samples grown during the seasons 1930–31 and 1931–32, and also the results of chemical analyses, yield, and feeding trials conducted in 1931–32 and 1932–33.

1. A Study of Types offered.

Allowing for a proportion of mixed commercial lines, the rapes offered in New Zealand may be classified fairly accurately into three major types:—

(1) Giant rape: A tall upright-growing form, with large broad pale green leaves and a somewhat open crown. (Fig. 1, *a*.)

(2) Broad Leaf Essex: A more dwarf form, characterized by a profusion of leaves resulting in the formation of a relatively dense crown. (Fig. 1, *b*.)

(3) Swede-like rape: A flat and spreading form, with bluish green leaves and open crown. For the want of a better name it is discussed here as "swede-like rape." (Fig 1, *c*.)

The varietal names under which rape seed is sold in New Zealand give no indication of type, but by growing the commercial samples it has been possible to place most of them in their respective groups, and the sample trials reveal that 32 samples proved to be Giant rape, 52 to be Broad Leaf Essex, 9 to be swede-like rape, while 27 were too mixed to classify.

Morphological differences enable the types to be recognized with comparative ease. Figs. 1, *a*, *b*, and *c* illustrate the fully developed plants, but growth form and habit offer uncertain means of identification in the field unless all forms are grown together under uniform spacing. The most useful distinguishing character is to be found in the presence or absence of hairs on the upper surface of

(*a*)

(*b*)

(*c*)

FIG. I. SINGLE PLANTS OF THE THREE TYPES OF RAPE.

(*a*) Giant; (*b*) Broad Leaf Essex; (*c*) swede-like rape. The same peg has been placed against each plant; with the Giant plant only the top of the peg is visible, where indicated by the arrow.

[*Photos by H. Drake.*

the leaf. Hairs are very numerous and easily observed on all young leaves of Broad Leaf Essex, although they tend to disappear as the leaves approach maturity. The hairs surmount a characteristic cushion-like structure which is illustrated in Fig. 2. A few hairs only arise on the leaves of the Giant rape, but these are confined to the margin or outer edge of the leaf, and the "cushion" is almost if not entirely absent. Swede-like rape is quite without hairs, and any difficulty in distinguishing it from the Giant form is negligible, since they are at opposite extremes in both habit and leaf colour.

FIG. 2. PORTION OF LEAF OF BROAD LEAF ESSEX ON LEFT, AND OF SWEDE-LIKE RAPE ON RIGHT.

On the Broad Leaf Essex note the hairs which arise on cushion-like structure. A few hairs arise on the leaves of Giant, but they are confined to the margin and edge of the leaf and the "cushion" is not pronounced. Swede-like rape carries no hairs.

[*Photo by H. Drake.*

Behaviour in Field.

The initial yield of rape is of far greater practical significance than its recoveries after being grazed. In the North Island rape is frequently followed by grass, and there is no time to make use of any autumn and winter recoveries. The aftermath in any case is generally recognized as not having the fattening quality of the initial growth. Recovery may continue well into the spring, when the plants commence to throw up flowering shoots, but in the yield figures given here only the initial growths and their recoveries are taken into account.

Table 1 shows the average of four trials conducted during the seasons 1931–32 and 1932–33. The results were very consistent in all trials.

Table 1.—Initial and (Two) Recovery Yields of Green Fodder, in Tons per Acre.

Giant.		Broad Leaf Essex.		Swede-like Rape.	
Initial.	Recovery.	Initial.	Recovery.	Initial.	Recovery.
10·5	6·7	9·7	7·0	8·5	5·1
17·2		16·7		13·6	

The Giant type has given the greatest initial yield, and also the greatest total yield when only two recoveries are taken into account. Broad Leaf Essex has given, however, considerably greater winter recovery, and its yield, when taken throughout winter and into the spring, exceeds that of the Giant type.

2. Chemical Composition and Utilization.

Chemical Analysis.

Chemical analyses are valuable, provided it is possible to interpret the results in terms of feed value. Rape is rich in protein, but the amount, and probably its nature, is largely dependent upon the stage of maturity of the crop. Rape cut three to four weeks before maturity—that is, three to four weeks in advance of the stage at which a farmer would commence feeding—contained 12·85 per cent. of dry matter, of which 16 per cent. was crude protein. An adjoining plot cut at the ideal feeding stage proved to contain 19·82 per cent. of dry matter, of which 11·08 per cent. was crude protein.

Farmers are careful not to feed rape before it has reached a stage of maturity which experience has indicated to them to be best, and the dietetic troubles from the use of young rape, and its lack of fattening properties, may perhaps be explained in the low percentage of dry matter containing a high proportion of protein. A similar position holds in the second growth, which is also lower in dry matter (16 per cent.), and this contains a higher proportion of protein (16·9 per cent.) than the initial growth (19·82 and 11·08 per cent. respectively). The recoveries are nearly always fed when immature, and might give quite satisfactory results were they allowed to mature fully.

The wide variation in composition dependent upon the stage of maturity necessarily means that chemical analyses must be interpreted in relation to the condition of the rape at time of sampling. Furthermore, in attempting to interpret such analyses in terms of feed value, it is necessary to take into consideration the fact that rape contains such a high proportion of protein to total dry matter that the protein may actually be in excess of requirements and the food balance upset. It is probably true, then, to say that under normal conditions rape contains ample protein, and that its fattening quality may best be gauged by a consideration of the dry matter content.

Taking into account nine analyses that can be regarded as fairly representative of both initial growth and recoveries during two years, we have the following comparisons :—

Table 2.—Protein Percentages.

—	Giant.	Broad Leaf Essex.	Swede-like Rape.
Dry matter percentage	14·75	15·31	15·93
Protein as percentage of dry matter ..	17·18	17·65	17·02
Protein as percentage of green weight ..	2·53	2·70	2·70

The swede-like rape contains the highest proportion of dry matter, and this was particularly marked in the 1931–32 season. It will be shown later that this type is the most rapid fattener.

In practice, however, one is more particularly concerned with live-weight increase per acre. Probably the factor determining this is the total production of dry matter and protein per acre, and by combining the yield and analyses of the four trials in which accurate estimates were obtained the following may be computed :—

Table 3.—Yield per Acre in Pounds of Dry Matter and Protein in the Initial Growth and Two Recoveries.

—	Giant.		Broad Leaf Essex.		Swede-like Rape.	
	Initial.	Recovery.	Initial.	Recovery.	Initial.	Recovery.
Dry matter ..	3,661	1,931	3,399	2,247	3,279	1,710
	5,592		5,646		4,989	
Crude protein ..	443	326	427	385	419	279
	769		812		698	

Table 3 gives a more accurate estimate of the feed value than does Table 1, which takes only green weight into consideration. Giant rape gives a higher per-acre yield of dry matter and protein in the initial growth, but Broad Leaf Essex leads in this respect when the two recoveries are included.

Palatability.

A number of palatability trials were undertaken, but these, although easy to conduct, are very difficult to interpret unless the differences are extreme. The requirements of the stock in relation to the maturity of the rape crop seem likely to be one of the prime factors, and conclusions could be accepted only after very many observations over a wide range of conditions, or carefully controlled trials in which the stage of maturity is accurately determined.

Fattening Quality.

Rape is grown almost exclusively as a fattening crop for sheep, more particularly lambs. The best rape, therefore, is one which will fatten the largest number of lambs per acre within a given period.

A fattening trial conducted at the Marton Experimental Area during the 1932–33 season was designed to give reliable evidence as to the fattening quality of the three types of rape. A full report on this aspect will not be available till after a second trial has been concluded next season. While the results given here may be regarded as inconclusive, they are nevertheless worthy of consideration in relation to the analysis and yield trials already discussed. The yield figures and analyses were obtained at Palmerston North, the fattening trials were conducted at Marton, twenty-three miles distant, under somewhat similar soil and climatic conditions. The fattening trials dealt only with the initial growth,

FIG. 3. LAMB FATTENING TRIALS AT THE MARTON EXPERIMENTAL AREA.

Giant rape in foreground. Four blocks of each type were grown and grazed in rotation.

[*Photo by H. Drake.*

and no account is taken of recoveries. Carrying capacity (or the number of lamb days per acre) and the live-weight increase per acre were as follows:—

	Giant.	Broad Leaf Essex.	Swede-like Rape.
Lamb days per acre	1,220	1,093	803
Live-weight increases per acre ..	279	213	197

It will readily be appreciated that a fodder which proves unpalatable might carry a large number of sheep per acre over a long period—that is, the lamb days per acre would be high. This was strikingly exemplified in the case of Maori cabbage, which was included in these trials. A more accurate estimate of the true value of these rapes is to be obtained by comparing the live-weight increase per acre. The results are in close accord with, although

not strictly proportionate to, the initial yields of dry matter shown in Table 3, and are compared in the following table :—

Table 5.

—	Giant.	Broad Leaf Essex.	Swede-like Rape.
	Lb.	Lb.	Lb.
Dry matter per acre, Palmerston North ..	3,661	3,399	3,279
Crude protein per acre, Palmerston North..	443	427	419
Proportionate live-weight increase, Marton	100	76·3	70·6

Considering now the rapidity of fattening—that is, the number of lamb days required to produce 1 lb. of live-weight increase—we find that lambs on swede-like rape required 4·1 days, on Giant rape 4·4 days, and on Broad Leaf Essex 5·1 days.

It is reasonable to expect that rapidity of fattening will be influenced by the concentration of dry matter in the several rape types. This is borne out when the analysis of the initial cut at Palmerston North is compared with the results of the fattening trial at Marton, which also took into account only the initial feeding. It was noticeable in the feeding trials that Broad Leaf Essex was eaten less readily than the other two types. This fact, while increasing the lamb days per acre, would necessarily decrease its rapidity of fattening, and must be taken into account when attempting to correlate the analysis with the actual feeding results obtained. The analysis figures in Table 6 are percentages of the green weight, and swede-like rape is taken as the standard for purposes of comparison.

Table 6.

—	Giant.	Broad Leaf Essex.	Swede-like Rape.
Dry matter	19·64	19·6	20·22
Actual number of days required to put on 1 lb. live-weight increase	4·4	5·1	4·1
Expected number of days required to put on 1 lb. live-weight increase on dry matter basis	4·22	4·23	4·1

A closer correlation is obtained when the nitrogen-free extract (soluble carbohydrate) is used as an index (Table 7), but still the unpalatable nature of the Broad Leaf Essex is in evidence.

Table 7.

—	Giant.	Broad Leaf Essex.	Swede-like Rape.
Nitrogen-free extract	11·57	10·78	12·11
Actual number of days required to put on 1 lb. live-weight increase	4·4	5·1	4·1
Expected number of days required to put on 1 lb. live-weight increase on nitrogen-free extract basis	4·3	4·6	4·1

Where the difference is not great rapidity of fattening cannot be regarded as very important. Under such circumstances live-weight increase per acre must remain the criterion.

Utilization.

The necessity for giving strict attention to the stage of maturity at which rape is fed is very well illustrated by the analyses already quoted. One point raised was whether a greater yield might not be obtained by commencing to feed rape rather earlier than would be the case under normal conditions, thereby obtaining heavier and a larger number of recoveries.

A trial designed to answer this question quite plainly indicates that if green weight only is taken into account early and frequent feeding (cutting in the case of these trials) will result in a greater yield. The crop was sown on 26th October, 1932, and the first cut was taken on 16th December, three to four weeks before maturity. The second cut, on 11th January, 1933, was made when the crop was judged ready for feeding. The figures take into account only Giant and Broad Leaf Essex, the swede-like rape being excluded because so few commercial crops are now of this type.

Table 8.—Yield of Green Fodder in Pounds per Acre.

Cutting Dates.	Block A—5 Cuts.	Block B—4 Cuts.	Block C—3 Cuts.	Block D—2 Cuts.
16/12/32	21,145	..	..	..
11/1/33	7,316	22,560	..	..
9/2/33	6,097	8,618	19,565	..
15/3/33	2,618	3,803	4,918	13,280
8/5/33	2,864	4,666	5,262	5,639
Totals	40,040	39,647	29,745	18,919

There is little difference between the total yield of the five cuts in Block A and that of the four cuts in Block B, but the first two cuts of Block A amount to 28,461 lb., while Block B during the same period of growth yielded only 22,560 lb.

Consideration of the green weights only is, however, very misleading. Considering the yield of dry matter from these same cuts the position is completely changed, as shown in the following table :—

Table 9.—Yield of Dry Matter in Pounds per Acre.

Cutting Dates.	Block A—5 Cuts.	Block B—4 Cuts.	Block C—3 Cuts.	Block D—2 Cuts.
16/12/32	2,654	..	..	..
11/1/33	1,190	4,426	..	..
9/2/33	911	1,341	3,443	..
15/3/33	407	631	924	2,890
8/5/33	415	679	788	1,024
Totals	5,577	7,077	5,155	3,914

Taking dry matter as a basis of feed value Block B, with only four cuts, is decidedly superior to Block A, with five cuts. The 28,461 lb. of green weight of the first two cuts of Block A has yielded only 3,844 lb. of dry matter, against the one cut of Block B which yielded 4,426 lb. of dry matter from 22,560 lb. of green fodder.

Obviously, then, feeding too early may increase green weight, but the indications are that it would be at the expense of fattening quality, and it is equally obvious that by feeding too late (9/2/33) a very great deal of waste may result. According to field practice rape should not be fed till it matures and shows a purplish blue tinge in the leaves. This stage is about coincident with the lowest concentration of protein and the highest concentration of dry matter—that is, when the nutritive ratio is at its widest.

About the period 9th February and 15th March heavy infestation by aphis and diamond-back moth caused a decrease in yield. Rain prior to 8th May explains the substantial recovery which appears in the tables.

Indications from Trials.

In these trials Giant rape has certainly shown its superiority over the other two types. If, however, the crop is required for use during winter and early spring the sowing of Broad Leaf Essex is indicated. It is yet too early to say whether Giant rape will maintain its superiority over Broad Leaf Essex under all conditions, more particularly the dry hot conditions experienced in the grain and seed-growing districts. Swede-like rape is definitely inferior to the others, and will be excluded from next season's trials. This type is not likely to appear on the market as frequently as it has in the past, since merchants have benefited by the sample trials and those importing this type have placed their orders elsewhere. The necessity of feeding rape only when it reaches maturity is strikingly emphasized by the results of chemical analyses.

3. Seed Production under Government Certification.

The varietal name under which rape is sold is no indication of type, as may be seen from the following results of sample trials:—

Table 10.

Number of Samples.	Commercial Name under which Seed was sold.	Classification of Samples into Type as indicated by Trial Plots.			
		Giant.	Broad Leaf Essex.	Swede-like Rape.	Mixed.
3	Giant	Nil	2	Nil	1
59	Broad Leaf Essex ..	17	28	6	8
9	Colonial	3	2	1	3
7	Kangaroo	1	2	1	3
42	Not specified ..	11	18	1	12

This unsatisfactory state of affairs would be remedied at once were our own seed requirements to be grown in New Zealand

under Government certification. It would permit each line of seed to be correctly described as to type, purity, and germination. Complaints regarding rape seed are not confined to New Zealand; one reads of a similar position arising in the Australian States, the United States of America, and elsewhere. New Zealand can grow high-quality rape seed, and not only should she grow her own requirements (which amount to about 225 tons annually) but, under a system of certification and a guarantee of type, it should be possible to stabilize an export trade. Australia uses a very large quantity of rape seed, and there seems no reason why New Zealand should not share in this trade.

Certification to be Inaugurated.

To assist in the establishment of this industry on a satisfactory basis the Fields Division of the Department of Agriculture has decided to inaugurate the certification of rape seed.

At the Marton Experimental Area seed is being raised of the Giant and Broad Leaf Essex types. This seed is the direct progeny of the best commercial lines in the trials of 1931–32. The seed will be available in January, 1934, for those who may desire to sow down areas for seed production. This in the meantime is the best seed available, but selection work is progressing at the Plant Research Station, and some of these selections may eventually replace part or whole of the commercial strains now available.

Advice to Growers.

Those who contemplate the production of rape seed would be well advised to grow only on contract, or at least to be assured of a market for their seed before taking any steps in its production. Fairly large areas of rape seed have been harvested in New Zealand in the past, and overproduction, or the production of seed for which there is no immediate outlet, has too frequently been the cause of disappointment. This perhaps more than any other factor is likely to wreck a promising industry. Were the Department in a position to refuse certification facilities at will, it would, in the interests of the grower and the industry, refuse to consider the certification of any crop unless the grower could prove a satisfactory outlet for his seed.

Applications and inquiries should be addressed to the Fields Superintendent of the district in which the grower is situated, so that arrangements may be made to draw a sample of the seed which the grower intends to sow. These samples will require to be in hand by 1st October in each year, so that ample time will be available for sowing these in the trial plots. A report on the samples should be available about January or February, and the grower would then have ample time to decide what to do—whether to graze the crop right out, or to graze lightly with the object of a seed crop in the spring.

The chemical analyses quoted here were undertaken by Mr. B. W. Doak, Analytical Chemist, of this Station. The results of the grazing and fattening trials have been supplied by Mr. A. W.

Hudson, Crop Experimentalist, also of this Station, from fattening trials undertaken at the Marton Experimental Area, and from field trials conducted by officers of the Fields Division in co-operation with farmers.

A detailed account of the yield trials and analytical work is being prepared by Messrs. B. W. Doak and R. A. Calder for publication in the *N.Z. Journal of Science and Technology*. An account of the grazing and fattening trials is to be prepared by Mr. A. W. Hudson and will appear in the *Journal of Agriculture* at the conclusion of next season's trials.

STARTERS FOR CHEESEMAKING.

METHODS OF PREPARATION AND MAINTENANCE.

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For many years the Agriculture Department's Bulletin No. 10, by Mr. W. M. Singleton, Director of the Dairy Division, has provided factory managers with a guide to the important points of starter-making(1). Other suggestions, such as appeared in an article by Mr. J. B. Sawers(2), have long been advocated by the Dairy Division's staff. In the present article the most up-to-date information from numerous sources has been reviewed with the object of assisting all concerned to maintain starters of satisfactory purity and vitality. Wherever possible quotations have been made, and the number in brackets after each quotation indicates the source in the list of references at the end of this article.

In the earliest days of dairying successful results were obtained by the use of "whey starters," or of good milk kept at such a temperature that it soured naturally in twenty-four hours. Although occasional failures occurred, these methods proved satisfactory for farm cheesemaking, but when larger-scale operations at factories were introduced troubles became more frequent, and the need arose to study what were the essential conditions for the preparation of good starters. These studies were undertaken particularly with starters used for buttermaking, and were developed first in Denmark, but other countries—particularly Germany, Holland, and America—were not far behind. In the last twenty years laboratory studies to evolve the best starters for cheesemaking have been intensively carried out at the West of Scotland College of Agriculture, and more recently, too, at the National Institute for Research in Dairying, at Reading (England), and at the Dairy Research Institute in New Zealand, as well as in America and in European dairying countries. Although there are still several points upon which further research is desirable, a very great deal of information has been discovered in researches which scientists of various nations have carried out during the past fifty years.

The history of starter-making has been well summarized in a paper which was published by Professor Soncke Knudsen of the

Royal Veterinary and Agricultural College, Copenhagen, in the Journal of Dairy Research, 1931(3). Another useful paper by Kelly(4) is not quite so accessible to New-Zealanders. Although the early researches dealt chiefly with starters for butter-making, much of the information obtained applies equally to those used for cheese-making.

In the manufacture and ripening of cheese the starter organisms fulfil at least four functions. The first of these is to ripen the milk before renneting. "At one time in the history of the cheese industry a starter was supposed to have accomplished its work when sufficient acidity for setting had been developed. Its work throughout the process of manufacture and in the curing was not recognized" (Singleton(1)). To-day the value of the starter in ripening the milk before setting is frequently overlooked. Cheesemakers would do well to pay more attention to the control of this part of the work by means of the rennet test. "When intelligently used and carefully interpreted, the rennet test enables the cheesemaker to secure a uniform ripening from day to day. Experimental evidence shows that the rennet test is a more correct index of the progress of ripening of the cheese milk than the acidimeter test" (Leitch(6)). The second function is a continuation in the vat of the preliminary acid-production prior to setting. Most cheesemakers to-day consider the most important function of the starter to be the development of acidity during the operations upon the curd in the vat. The third function relates to the process of ripening, in which the influence of the starter organisms is frequently not realized. Professor Knudsen states on this point: "Since it must be assumed with Orla-Jensen that it is the enzymes liberated from the dead cells which are particularly active in cheese-ripening, it may well be thought that the streptococci are the chief agents even though they die very quickly when once the cheese is made"(3). The fourth function is to restrain the growth of undesirable organisms. No harm is done by the presence in small numbers of various bacteria in the milk or cheese, but defects may occur if these multiply unduly. Multiplication is prevented, in part at least, by the growth of the lactic acid bacteria.

In order to perform these four functions a good cheese starter should fulfil three requirements: (1) It must contain the right bacteria; (2) it must possess vitality—*i.e.*, must be capable of developing adequate acidity when used in a cheese-vat; (3) it must be free from contamination. These requirements may now be discussed.

(1) The right bacteria in the best butter cultures include a mixture of types of streptococci, chiefly *S. cremoris* and *S. lactis*, together with some like *S. paracitrovorus*, which improve the butter flavour. The opinion has long prevailed that for cheesemaking we should similarly have a mixture of types, but Kelly states: "According to Orla-Jensen and others *S. lactis* is an organism producing lactic acid freely in milk with little or no aroma or flavour, while *S. cremoris* produces an equal amount of acid with

a pleasing aroma and flavour. This being true, it might be considered that *S. cremoris* would be more desirable for cheese-making "(7). Although Kelly favours pure cultures of *S. cremoris* he has been able, like other investigators(14), to make equally good cheese with pure cultures of *S. lactis*. I have recently been informed that in Australia for some years Cheddar cheese of excellent flavour has been successfully made from pasteurized milk, using a pure culture of *S. cremoris* alone. Most factory starters include both types in varying amounts, as well as a small proportion of *S. paracitrovorus* type. This last appears to be of value in improving the flavour of the starter itself rather than of the cheese. Should mishaps or careless handling (*e.g.*, over-ripening) allow it to become the dominant organism in the starter, slow acid-development and bitter cheese may be produced(14). Doubts therefore arise as to whether a cheese starter should, like a butter culture, contain a mixture of types. The lactobacilli, which are strong acid producers in milk, increase to large numbers in mature cheese, but it is doubtful whether cultures of these should be added to the cheese-vat. A great deal of excellent cheese has been made by men who are quite unacquainted with these bacteriological details of the types of germs in their starter. Having obtained a culture from a reliable source, their chief concern has been to maintain its vitality and freedom from contamination.

(2) Kelly's statement that "the production of lactic acid is the main essential of a good cheese starter "(7) will have the support of most cheesemakers. Slow starters are responsible for a great deal of anxiety to factory managers, who are continually on the lookout for means of avoiding this trouble. Although not very much is known for certain about the causes of loss of vitality, it may be useful to outline briefly the available information. "Getting starters constantly overripe," remarks Singleton, "is one of the most potent factors which are conducive to a loss of vitality in the lactic-acid-producing germs "(1). From time to time evidence has been gathered suggesting that various organisms may be responsible for reducing the vitality of starters. Investigations(15) have shown that organisms from the same pure culture may vary considerably in their ability to develop acidity, while recently a "streptococcus indistinguishable in appearance from a lactic streptococcus" has be found actually to restrain acid production(8). According to Knudsen—"Some strains of the bacteria, ordinarily found in the starter, grow very badly in aseptic milk, even when this is sterilized, so that there can be no question of any effect of bactericidal substances, whereas other strains of the same genus grow very well in the same milk. Thus we have been able to isolate some strains of *Sc. crem.* presenting this phenomenon "(12). Trouble of this nature should disappear on obtaining a different culture from a reliable source.

Obscure abnormalities may sometimes occur in the milk, or perhaps be produced by its treatment, but in most factories plenty of milk can usually be found which will make good starter. "It has long been clear that milk from sick animals is not suitable for the preparation of starter," says Knudsen(3). Professor Leitch in the summer of 1930 observed a case where as little as a pint of

milk coming from one bad quarter of a single cow was sufficient to prevent acid development in milk from a herd of fifty cows(9). He states: "A single batch of bad milk may permanently injure the most desirable pure culture starter. Mammitis milk is especially unsuitable. Pasteurization of such milk does not render it more suitable for culturing. As a rule the mixed milk of several cows in the herd is preferable to the milk of one cow alone, since it sometimes happens that the apparently normal milk of a single cow exerts a strong restraining effect on the starter organisms, and thereby weakens the starter. Milk which is selected for starter-making should be obtained under very clean conditions."

(3) In addition to using milk produced under clean conditions, the starter itself must be prepared under the cleanest possible circumstances. Certainly cases are known of factory managers who are very careless with their starter but who never experience any trouble. More by good luck than otherwise they maintain a starter which appears to work well in the vats. This apparent success may often be due to the fact that the starter has some contamination regularly present which actually helps to maintain its vitality. Professor Leitch writes: "Such starters are seldom pure; yeasts and moulds are common contaminants; on occasion, gas-producing and putrefactive germs may be present. The occurrence of these micro-organisms in the starter has frequently an invigorating effect on the associated lactic acid bacteria. . . . When, however, vigour in starter is secured at the expense of purity in the culture, defects (and more especially flavour defects) in the manufactured products are almost certain to occur. It is bad policy to employ a starter merely because it is 'sharp' and active. If it has not the essential quality of purity, starter will always be a source of danger in cheesemaking. A coarse, 'sharp' starter is seldom pure"(6).

Under careful control many contaminating types of bacteria will sooner or later die out, but some undesirable types will grow readily in the starter for a long time. The reason for persistent contamination with such types as coliform organisms, which readily die out, is that the operator handling the starter recontaminates it every day by some trifling mistake, such as the use of an unsterilized plunger or thermometer in the milk at the time of inoculation. A contaminated starter which goes well in the vats gives a false sense of security, for although the green cheese may appear satisfactory no one can say what off-flavours may develop with maturity. On the other hand, a pure starter which loses its vitality gives rise to abnormal conditions in the vat for a day or two, but the cheesemaker cannot fail to realize the trouble and take immediate steps to rectify it. However, some factory managers who take special care to avoid contaminating their starters experience more than their share of trouble. This is partly because a pure culture is more sensitive than a contaminated one to slight changes of conditions, and so will more readily "go off." Such changes of conditions are chiefly three: (*a*) Changes in the milk; (*b*) inoculation with varying amounts of starter; (*c*) variations in temperature of the starter milk—in cold weather sufficient acidity may not develop, while in hot weather the reverse may happen.

Care of Starters.

Starter Room.—The first essential for good starter-making is a proper separate room for the purpose, situated on the cool south side of the factory. Such a room is of no value unless it is kept in satisfactory condition. Owing to the amount of steam used ample provision should be made to ventilate the room with plenty of large windows. By fitting with horizontal top hinges the windows can be arranged to open inwards above the starter trough and other steam vents, so that the waste steam can escape direct to the outside air. If a steaming tank is used to sterilize the utensils the exhaust vent should be carried outside the factory. In spite of ventilation the starter room will tend to be damp and mouldy, so the walls should be lime-washed regularly, at least once a month during the season. The objection is usually made that this practice leads to flakes dropping off the walls into the milk, but these flakes can only add a little more lime to the milk, which is greatly to be preferred to having it inoculated every day with spores from mould-infected walls.

Utensils.—Many factory managers who take a great deal of care with their starters do not succeed through lack of adequate equipment, particularly a steam sterilizing chest and a reliable means of keeping a mother culture.

The equipment required for the main supply of starter will be first discussed. Rusty or battered cans should be avoided, as milk which lodges in crevices is difficult to remove and harbours undesirable bacteria. Recently there has been a tendency to use one large container or special starter tank instead of several separate cans. Such containers are very satisfactory if they have proper covers, and also if they have both an ample water jacket and proper insulation round the outside. Both methods have advantages and disadvantages. Many factories continue to get satisfactory results by using separate cans set in a large trough, *provided sufficient care is taken to wash and sterilize the cans thoroughly and otherwise give proper attention.* Thus different suppliers' milk or different starter cultures may be used in different cans, so that a failure should be confined to one particular can. Where factories are not disposed to install expensive starter vats proper facilities should at least be provided for carrying a mother starter. In some factories the cans are lifted out of the trough and stood on the floor, where temperature changes occur much more readily. The best results are obtained when the starter cans are maintained at uniform temperature, and for this purpose they should be left in the trough, because with the large bulk of water adjusted to the required temperature less variation should occur, but leaky steam valves or water taps must of course be eliminated. In cold weather a drop in temperature can be obviated by the use of a small electric heating element([10]). Such an element can be easily made up of nichrome wire suitably insulated and enclosed in a $\frac{3}{8}$ in. watertight flexible copper sheath. To distribute the heat the sheath should be about 9 ft. long, and if controlled by a three-heat switch will consume 50 watts on low, 100 watts on medium,

and 200 watts on high. In warm weather cooling may be necessary, and can usually be secured by means of a *carefully regulated* trickle of water.

The starter cans should be provided with metal covers having a lip which overlaps the outer rim of the can. Such covers prevent loss of heat, so that pasteurization is more efficient; they are easily washed and sterilized, and are a sure preventive against contamination of the starter by splashes of water from the cooling trough, or by moulds and bacteria which are always floating in the air. Many cheese factories after pasteurization spread cheesecloth over their starter cans. Even if the cloth is thoroughly boiled each day it is very difficult to keep sanitary, and is not nearly as satisfactory as metal lids. A plunger is necessary to stir the milk during heating and cooling, and the best plan is to have a separate one for each can, so arranged that it passes through a hole in the lid. In this way a frequent cause of contamination can be avoided, for there will be no need to remove the plunger from the can. When only one plunger is available it must be lifted from can to can; in transferring it may become contaminated by moulds, yeasts, &c., from the air, or by splashes of cooling water of doubtful quality; worst of all, it may be set down upon the apparently clean floor and then returned to the pasteurized milk with little more than a brief rinse in warm water.

Thermometers are desirable in both the cans and the trough, but each should be kept for the one purpose. Contamination is sure to occur if a thermometer is taken from the water in the trough and put into the milk. The thermometer in the milk may have attached to it a piece of copper wire which can be hooked over the rim inside the can. In addition to proper washing and scrubbing, all starter utensils should be thoroughly sterilized every day. "A steam sterilizing oven into which all utensils used in this connection may be placed and thoroughly steamed for an hour or more is to be strongly recommended. Many of our dairy companies could with advantage go further and have the sterilizing oven of such larger dimensions as would accommodate all the smaller factory utensils" (Sawers(2)).

A makeshift oven can be improvised by placing small utensils in a 20-gallon can, which is then inverted on an iron plate over a steam jet so that the escape of steam is limited. Thus the can is quickly heated, and should be left steaming for half an hour. After taking the trouble thus to sterilize their starter utensils some operators allow them to become contaminated with splashes of water and milk. The advantage of a sterilizing oven is that the utensils can be left in it and thus remain sterile until required for use.

Milk.—When the milk selected for starter purposes is received at the stage provision should be made to weigh it separately, so that it will not become contaminated in the factory weigh-vat. "Practical cheesemakers are fully alive to the necessity for obtaining absolutely clean fresh milk for the making of starter. With a view to making sure that the milk attains such a standard, curd tests should be made or samples submitted to the reductase and fermentation test" (Sawers(2)). The cleanest available milk is put

into sterilized cans to be pasteurized, so as to minimize troublesome contamination. From this stage onwards the cans should have metal covers on them.

The method of pasteurizing the milk varies considerably according to the equipment available. Leitch states: "Effective pasteurization is accomplished by retaining the milk at a temperature of 190° F. for one hour, and subsequently cooling it to the temperature of inoculation. If, however, the milk is several hours old at the outset (as when the milk of the previous day is used), and especially if it has been in contact with unsterilized utensils, or if it is of unknown or uncertain quality, the method of double pasteurization should be practised. In this case the milk is heated to 190° F. and kept at this temperature for thirty minutes; the heated milk is then cooled to 90° and held over for a period of two hours; it is again heated to 190° for thirty minutes, and finally cooled to the inoculation temperature"(6).

Higher temperatures and longer times than the foregoing have been successfully used by some factory managers, but if good starter cannot be made from milk treated as suggested excessive pasteurization is not likely to effect any improvement, and the reason for failure should be sought elsewhere.

Inoculation.—The starter bacteria grow best at a temperature of 68° to 72° F., to which the pasteurized milk should be cooled prior to inoculation. In hot summer weather 68° is preferable, while at cooler seasons 72° should be aimed at to allow for changes during the night. Care must be taken in measuring the amount of starter used to add to the milk for the next day's batch. This depends upon the temperature at which the milk is to be kept and the time allowed for ripening. If these two factors are kept constant the same amount of culture should be required each day, but different starters may require different amounts. Owing to the difference in conditions, the percentage used to inoculate the next day's starter will not necessarily be the same as that which is found best to use in the vats. Although good cheese has often been made with smaller amounts of starter, about 1 to 1½ per cent. is usually found satisfactory. When an excessive percentage is required, either in the vat or for inoculating the starter, it is usually good policy to obtain another culture. "The lower the percentage that will produce the desired results at moderate temperatures the longer will the starter do its best work" (Singleton(1)). After mixing the culture through the milk it should be left undisturbed to ripen.

By next morning the starter should become sufficiently acid to make it satisfactory for use in the cheese-vat. The acidity of each can should be tested every day, care being taken to rinse the pipette with a definite amount of clean water, which is added to the cup before titration. Opinions vary as to the best acidity, but ·85 per cent. is agreed to be a maximum, while ·75 is frequently thought to be on the low side, although some cheesemakers prefer not to exceed this figure. For example, Professor Sammis, the veteran Wisconsin cheesemaker, writes: "A good lactic starter should have a pleasant, mild, acid flavour and odour, as a sharp,

sour flavour like vinegar is likely to show also in the cheese. The texture should be free from gas holes, and should not be wheyed off (at 72° F.), but be smooth and creamy in order that when stirred into the vat the lactic germs may be easily distributed through the milk and not retained in lumps of curd. A starter contains the largest number of living, active lactic germs when its acidity is about ·6 to ·7 and it is just recently thickened at 72° F. It is then in the best condition either for adding to the cheese-vat, or for transfer to another lot of milk for starter making. With proper handling a good starter can be kept in daily use without deterioration for a long time, sometimes for months or years "([16]).

The starter may need to be skimmed and strained before use. Care should be taken to avoid putting it into the vat and leaving it for about an hour without adding *more warm milk to keep the organisms actively growing*. Starters are frequently allowed to be overacid when added to the vat. Worse still, a bucket of the already overacid starter is allowed to stand about in the hot factory air for several hours before being used to inoculate next day's starter. This objectionable practice may not increase the acidity by more than a few points, because the already high acidity is devitalizing large numbers of the bacteria so that they are incapable of producing more. Leitch writes in this connection: "Systematic exposure of the fully ripened starter will nearly always lead to chance contamination by yeasts and moulds. These micro-organisms are carried over and increased in numbers with each successive transfer, with the result that the starter becomes progressively impure. When the mother-culture method is employed such infection is more easily circumvented. To the careful and intelligent cheesemaker and to the factory manager the mother culture will always be found of distinct advantage "([6]).

In factories where a mother culture is not used the portion for setting next day's starter should be placed in a sterilized can *with a lid* and set aside in the coolest available place, preferably a butter cool room. Should a starter at any time tend to become overripe, prompt cooling (preferably in ice water) is essential to prevent it from deteriorating. A simple factory test of the quality of a starter is to fill a sterilized bottle with the starter milk immediately after inoculation with the culture. After closing, this bottle is kept unshaken in a warm place at a temperature of about 70° F. After several days it may be examined to see if it has developed gas bubbles, or a bad flavour, or has wheyed off.

(To be concluded in next month's issue with sections on the Use of Mother Starters, &c.)

Vitamin E.—The third annual report of the Wheat Research Institute remarks: "The Institute's work on the vitamin E in wheat germ is another example of the establishment of industries based on its investigations. Wheat germ-oil for the supply of vitamin E in a concentrated form, and germ-meal to supply it dilute as a food, are now both being commercially manufactured in New Zealand."

ORCHARD SPRAYS IN NEW ZEALAND.

V. THE OIL SERIES—*concluded.*

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Effects of Oil Sprays on Insects and Plants.

Oil sprays are applied to deciduous or evergreen trees and shrubs during the winter or summer, with a view to destroying insets and their eggs. The position is complicated in that several factors are involved.

Firstly, since the possibility of injury depends on both the type and concentration of the oil employed and also the variety of tree and its period of development, special oil sprays must be used for applications to (*a*) dormant deciduous trees (winter oils), (*b*) deciduous trees in leaf (summer oils), and (*c*) evergreens, as citrus trees.

Secondly, the choice of an oil is influenced by the degree of protection afforded the insect, and the method by which it overwinters. Hibernating insects may be protected by a felted waxy coat (as with woolly aphis and mealy bug); and insect eggs are enclosed in an impervious chitinous capsule (red mite) or a heavy waxy shield (scale insects). Consequently the oil film applied must be sufficiently heavy to cover these with an impervious layer which will remain sufficiently long to encompass their destruction. As such applications would cause injury to other than dormant deciduous trees and shrubs, they can be employed with safety only during the winter months. In the summer soft-bodied insects and thin-walled eggs are relatively unprotected, so that a heavy film of oil is unnecessary and liable to cause injury to the tree.

These results cannot be secured (as yet) by one general type of oil, for, in addition to differences in oil concentration, differences are also necessitated in viscosity, volatility, iodine value, and, to a lesser extent, in the emulsifier employed.

EFFECTS UPON INSECTS.

From a survey of the available literature it appears that oil sprays are held to destroy insects and insect eggs in one of two ways: (*a*) By the toxic action of certain volatile constituents, or (*b*) by asphyxiation.

The former, until recently, was the belief generally held, following the work of Shafer (1911), who concluded from his experiments that death of insects was induced by the toxic action of gases produced by such oils as kerosene or petrol. In consequence of this belief many attemps have been made to utilize as insecticides volatile derivatives of petroleum and tar, but for the most part with disappointing results.

There is a growing tendency, however, to consider that the latter action is the more probable and that death is induced through oils functioning as asphyxiants. Moore (1918) showed that when larvæ (of the wax moth) were immersed in oils, the tracheæ

became blocked, and death resulted through suffocation. De Ong, Knight, and Chamberlin (1927) confirmed this, and demonstrated that petroleum oils with a wide viscosity range may readily penetrate tracheæ (of scale insects). They made the important discovery that oils with a low viscosity, as the kerosenes, penetrated readily but were rapidly expelled by the insect, whereas those of higher viscosity, as the lubricating oils, were not expelled, but remained to plug the tracheæ and so cause death. Recent work tends to support the belief that oils act in this manner, and specifications of modern oils are in fact based on the assumption that they act as asphyxiants.

Effects upon Plants.

The injury produced by oil sprays may be grouped under two general headings: (*a*) Necrosis, and (*b*) physiological disturbances.

Necrosis is indicated by spots on the leaves and fruits, marginal killing of leaves, russetting of fruits, and killing of laterals, fruit spurs, fruit buds, or branches. Leaf and fruit injury is caused usually by the use, during the summer months, of oils with too high an iodine value, and less frequently through the employment of a summer oil with an unsuitable emulsifier. Death of laterals or branches is caused by the application of winter oils at too great a concentration; and of fruit spurs and fruit buds through applications at other than the dormant period.

Physiological disturbances may be indicated by yellowing and fall of a few leaves within a few days of the oil application; where injury has been more severe and prolonged, leaf-fall may continue for weeks, and result in partial or total defoliation of the tree, loss of fruit and, in severe cases, death of terminals. The number of fruit buds may be reduced, and the colouring of the fruits impaired. These abnormal conditions appear to be due to the effects of the oil upon the leaves, for it penetrates into and partially blocks the stomata, resulting in decreased photosynthesis and rate of transpiration, and increased rate of respiration, the degree of injury being affected by the concentration and viscosity of the oil employed. Resumption of normal processes of the leaf is dependent upon elimination by the plant of the oil from these tissues (Knight, 1928; Brock, 1929; Knight Chamberlin, and Samuels, 1929).

Claims are frequently made by manufacturers that oil sprays stimulate plant growth, increase blossom and fruit set, nourish and soften the bark, increase the colour of the fruit, &c. Little if any experimental evidence is available to show that oils act in such tonic fashion, though indirectly they may improve the general tone of the tree by destruction of insect pests. The apparent prolongation of the foliage which occasionally follows autumnal applications of summer oils would at first appear to be an example in support, for the leaves remain green and attached to the trees for an appreciable time after those of contiguous unsprayed trees have fallen. This can scarcely be considered an advantage to the tree, as it appears to be due to slowing of the metabolic processes of the leaf through partial blockage of the stomata, and from available evidence appears adversely to affect the fruit-set for the following season.

An additional claim is that oils may be used to advance or retard the blossoming period of fruit trees (Herbert, 1924; de Ong, 1928, *bis*). This claim, unfortunately, has not been supported by experimental evidence. On the contrary, it has been the experience of the majority of workers that the time of application has little if any effect upon the period of blossoming. Although apparent retardation of blossoming is not infrequently noted when oils have been applied after dormancy has broken, and buds are beginning to swell, this would appear to be due merely to the killing of the most advanced blossoms.

Factors governing Application.

Viscosity is perhaps the most significant factor involved, as upon it depends both insecticidal efficacy of an oil spray and the possibility of injury to the tree. As both increase with an increase in viscosity, the effective range lies between the maximum viscosity which can be used with safety and the minimum which will give effective control.

These limits are affected by the purpose for which the oil is required. The minimum for winter oils used as ovicides must be sufficiently high to enable a permanent oil film to be produced, as upon this depends its efficacy. The maximum is relatively unimportant, and is fixed by the increasing difficulty of emulsification, which increases with viscosity, rather than by the liability to cause injury to dormant deciduous trees. American experience has shown that the minimum for winter oils designed for application to dormant deciduous trees is in the vicinity of 72 seconds (Redwood I); but for New Zealand conditions, our experiments of the past three seasons indicate that this is too low, a viscosity of 125 seconds being preferable. For winter applications to citrus trees it would appear that the highest viscosity which may be applied with safety is about 85 seconds.

For summer applications, the permanence of the oil film is scarcely significant, as the oil must be viscous enough to cover those insects with which it comes in contact, yet be heavy enough to plug tracheæ (or cover summer eggs) without causing injury to the plant. American workers have shown that the minimum and maximum range is close, lying between 45 and 85 seconds (Redwood I) for both citrus and deciduous trees in leaf.

Volatility, as measured by the rate of evaporation, is significant in a winter oil, as it directly affects the permanence of the oil film. Chandler, Flint, and Huber (1926), de Ong (1928), and Swingle and Snapp (1931) have shown that the evaporation loss should not exceed 2 per cent. in 4 hours at 105° C.

The volatility of summer oils has a different significance, for with these a permanent film is not only unnecessary but also liable to cause injury. Consequently a relatively high volatility may prove an advantage. No figures are yet available, but, judging from the analysis of several summer oils tested in New Zealand during the past three seasons, it appears that this loss may range between 30 and 40 per cent. in 4 hours at 105° C. without impairing the efficacy of the spray.

The iodine value of an oil is significant in that it partially differentiates between a summer and a winter oil. It is directly correlated with injury to leaves and fruits; so that if injury is to be avoided summer oils should not possess an iodine value greater than a specified figure. This should be as low as possible, the permissible maximum being about 6, judging from our recent experiments. The figure, however, may be a variable one, as the possibility of plant injury depends on the oil concentration of the spray, the viscosity of the oil, and the tolerance of the plant, as well as the iodine value of the oil. A winter oil, on the contrary, may have a much higher value, and, provided applications are confined to dormant trees, our experience shows that this may range from 20 to 30 without noticeable injury to the tree.

Although de Ong (1928, *bis*) claimed that refining an oil removed much of its insecticidal properties it would appear that the iodine value is relatively unimportant from an insecticidal viewpoint, as there is no evidence available showing that it is correlated with toxicity of oils towards insects or insect eggs. On the other hand, it is more than probable that the unsaturated (including aromatic, if present) hydrocarbons as measured by sulphonation, may by dilution or some other action impair the permanence of the oil film.

The emulsifier employed, and the type of emulsion produced, have been held by many workers to influence the toxicity of oil sprays. Unfortunately, published results are too conflicting to allow of any particular emulsifier being given preference over the many others in use. It would appear, however, that the most satisfactory emulsions are those prepared from boiled-soap stock, or miscible oils, as they are stable and give good control of pests.

Quick-breaking emulsions were said to be more effective than permanent emulsions as insecticides (de Ong and Knight, 1925; Porter, 1927; de Ong, Knight, and Chamberlin, 1927); but more liable to cause injury owing to the greater volume of oil deposited on fruit and leaves (Spuler, Overley, and Green, 1931; Penny, 1932).

The emulsifier employed may also cause injury by its action on the components of other sprays. Thus, if summer oils containing ammonia compounds as emulsifier or stabilizer be applied to trees soon after or before spraying with lime-sulphur or sulphur, the ammonia may react with the sulphur on the tree and so produce compounds toxic to leaves and fruit. It has been found in practice that this risk is removed if an interval of at least ten days elapses between the application of oil and sulphur sprays.

The oil concentration of the spray is also of importance. Formerly, all recommendations were based on the assumption that the bulk concentrate possessed an oil content of 100 per cent., and applications were recommended at as high concentrations as the tree would tolerate without appreciable injury. Thus for applications to dormant deciduous trees dilutions of "1–8" or "1–10" were usually recommended, which represent the unnecessarily high oil concentrations of 14 and 10 per cent. respectively. Recent work of the past three years has shown that for New Zealand conditions concentrations need not be greater than from 3 to 5 per

cent. for applications to dormant deciduous trees, and from 1 to 2 per cent. for summer applications, provided oils comply with the specifications outlined.

Suggestions for the Use of Oil Sprays.

As has been shown, the specifications of oils to be used differ according to whether the spray is intended for winter or for summer application. This distinction is necessary if effective control is to be secured without danger of injury to plant tissues. The following suggestions are necessarily tentative, and are offered as a guide until such time as the investigations now being conducted at this Station place the use of oil sprays on a more certain foundation.

Winter Oil Sprays.

These are recommended for the control of insect pests, as woolly aphis and scale insects, which overwinter on the tree. For oils of this type consideration should be given to those factors which aid in the production of a permanent oil film upon the tree, since upon this feature depends the efficacy of the oil. Thus the viscosity should not be less than 85 seconds, and may be increased to 125 seconds or more with advantage; the volatility should be very low; the iodine value should be not more than 30, and the volume of unsaturates not greater than 35 per cent. Miscible oils or boiled-soap stock emulsions are recommended as giving satisfactory emulsions.

Winter oils should be applied only during the winter months, being used on dormant deciduous trees and citrus trees during the months of June, July, and August. Owing to their high cost, winter oils are recommended only against the pests listed, and then only when these become troublesome.

These oils may be applied at the following concentrations, *provided they fall within the specifications outlined:* 3 per cent. for woolly aphis, lecanium scale, and mussel scale of deciduous trees; or black scale, red scale, or cottony-cushiony scale of citrus; 4 to 5 per cent. for San Jose scale of deciduous trees.

Summer Oils.

These are recommended for the control of black and green aphis, red mite, leaf hopper, and thrips; and they may be used additionally against young scales and cherry slug on those trees which will not tolerate arsenical sprays. Summer oils should comply closely with the necessary specifications, and should be applied as nearly as possible at specified periods, since they are most effective when insects are readily exposed to attack. Two close-ratio applications are recommended, as owing to the cover provided by the foliage, it is seldom possible to secure a complete kill with a single spray. The second application, following about ten days after the first, destroys the majority of those pests missed by the first spray, and those which may have hatched from eggs during the interval.

The viscosity should be between 45 and 85 seconds; the volatility not less than 30 or more than 50 per cent. in four hours

at 105 C.; the iodine value should be not more than 6; and the emulsion should preferably be of the permanent type. Summer oils containing ammonia should be avoided if sulphur sprays are to be used on the same trees, unless a fortnight at least be allowed to lapse between an oil and a sulphur application.

For the control of red mite two applications are recommended, at concentrations of 1·5 to 2 per cent. (the weaker being for less tolerant varieties), the first during the first week of February, the second about ten days later. The period of application may be varied from mid-January to mid-March, according to the lateness of the season and the prevalence of the pest, the time specified giving, in general, satisfactory control. Summer oils are recommended for the control of red mite in preference to the winter oils commonly employed, as our experiments of the past three seasons have shown that they are decidedly more effective, two close-ratio applications of a suitable oil, applied at the periods specified, effectively destroying the pest and rendering trees free for from twelve to eighteen months. Winter oils hold red mite in check until about mid-December, but after that period both sprayed and unsprayed trees become equally heavily infested. It is possible that the habit of the pest in laying its eggs in protected places (as under loose bark, in bark crevices, bud scales, &c.) is responsible for the failure of winter oils to combat red mite, rather than their ineffectiveness as ovicides.

For leaf hopper apply a concentration of 1·5 per cent., the time of application being governed by the appearance of the nymphs. For black and green aphis and cherry slug apply a 1 per cent. concentration when the pests are about to appear in numbers, and follow with a second application if within four or five days of the first application living insects are noticeable.

For scales on citrus trees a 4 per cent. concentration may be applied during the winter months; outside this period, especially during September and October, the concentration should be reduced to 2 per cent. Summer oils are recommended for applications to citrus trees, even during the winter months, as they are less liable to cause injury, provided the specifications follow the lines indicated.

Preparation of Oil Sprays.

To avoid an unsatisfactory mix oil sprays should be prepared in the following manner: The required quantity of the concentrated miscible oil or stock emulsion should be measured out into a clean container, as a barrel or petrol tin, and to this should be added water taken from the measured volume in the spray tank (about half a gallon of water for each gallon of concentrate). This is well stirred until a white paste or cream is formed, and then additional small quantities of water are stirred in until a thin cream has been produced. After standing for a few minutes the mixture should be free from surface oil. The mixture should then be added to the specified volume of water in the spray tank, being poured in slowly while the agitator is running.

Under certain conditions quantities of oil may rise to the surface or coat the sides of the tank. The presence of free oil is

an indication that something is wrong, and whenever such a condition arises the cause should be sought and remedied before spraying is proceeded with. A spray with much free oil is dangerous to apply, as the bulk will have too little oil for insect control, and the residue containing the concentrated oil will in all probability cause severe injury to the tree.

As this trouble may be caused by the presence of lime-sulphur or bordeaux mixture residues in the tank, it is important that the latter be thoroughly cleaned before attempting to mix an oil spray. The principal cause of an imperfect mix is the employment of hard water. When such is used with oils emulsified with soaps the latter are decomposed to form magnesium or calcium soaps, which are insoluble in water and lead to the production of free oil and a curdy precipitate which is apt to block the nozzles. The addition of excess soap, or of an alkali such as caustic soda, to the concentrate during the preliminary mixing usually overcomes this trouble. But where very hard waters are encountered the only remedy is to use oils emulsified with non-soap emulsifiers of the calcium caseinate type.

Orchardists are warned against the use of waste lubricating oils taken from the sumps of motor engines, as their use may lead to severe injury, owing to the presence of certain acids formed during the production of "sludge" and of petrol or kerosene dilutants which generally accumulate in such products. Moreover, with most of these oils the viscosity is too high for the production of suitable sprays, especially with oils of the heavier grades frequently used in petrol engines.

ACKNOWLEDGMENTS.

We are indebted to Mr. L. F. Elsby, of the Shell Company of N.Z., Ltd., for information concerning the petroleum industry, and the loan of literature covering the subject; and to Mr. R. L. Andrew, Assistant Dominion Analyst, Wellington, for much helpful criticism of the manuscript.

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CONTROL OF CASEOUS LYMPHADENITIS IN SHEEP.

PROGRESS OF THE FLOCK TRIALS.

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IT seems desirable to report the further progress that has been made in the control of caseous lymphadenitis by the methods fully described by the present writers in the July, 1932, issue of this *Journal* (Vol. 45, No. 1, pp. 1–9). The results are proving very satisfactory, and there is now no doubt that the disease can be definitely controlled under practical field conditions.

The following table shows the position in the ewe flock under observation after the third annual examination by the palpation method, carried out in 1933 :—

Table 1.

Number of Sheep examined.	Age.	Number found affected.	Percentage.
3,180	Two-tooths ..	8	0·25
2,246	Two years rising three	21	0·93
3,494	Three years rising four	82	2·35
2,399	Four years rising five	98	4·08
11,319	..	209	1·85

The results of the three examinations of this ewe flock may be summarized as follows :—

First examination, 1931 : Number examined, 11,196 ; affected, 1,046 = 9·34 per cent.
Second examination, 1932 : Number examined, 10,129 ; affected, 377 = 3·72 per cent.
Third examination, 1933 ; Number examined, 11,319 ; affected, 209 = 1·85 per cent.

The figures for the examinations of the wether flock are equally illuminating. They have not been published previously, as the first examination was made in 1932. The results were as follows :—

Table 2.

Number of Sheep examined.	Age.	Number found affected.	Percentage.
875	Two-tooths ..	20	2·28
986	Two years rising three	40	4·06
1,200	Three years rising four	115	9·58
713	Four years rising five	71	9·95
844	Five years, rising six..	124	14·69
4,618	..	370	8·01

The wether flock was again examined in 1933, with the following results :—

Table 3.

Number of Sheep examined.	Age.	Number found affected.	Percentage.
1,219	Two-tooths ..	3	0·24
667	Two years rising three	20	2·99
975	Three years rising four	37	3·79
1,158	Four years rising five	65	5·61
692	Five years rising six ..	24	3·47
4,711	..	149	3·16

As has been previously pointed out, the left side glands are more commonly affected than the right. This fact was again amply demonstrated in the course of the foregoing examinations.

Examination of the North Island flock, which was carried out this year by the staff of the sheep-station, and not by one of us (C. S. M. H.), gave the following results :—

Table 4.

Age.	Number palpated.	Number found affected.	Percentage.
Four-tooth ..	6,520	71	1·08
Six-tooth ..	3,338	77	2·31
Eight-tooth ..	3,598	135	3·75
Five-year old ..	5,207	236	4·53
Total ..	18,663	519	2·77

The percentage of infection in this flock for 1932 was 3·32. The percentages in this case have not dropped as far as one would have wished, but the owner is confident that he will make a greater impression this coming season.

As a direct result of the success of this work three other flocks are under special observation at the express request of the respective owners.

Recent work carried out with guinea pigs in Australia suggests that the dust of the yard and sheds is not particularly dangerous as a means of infection of animals, but several cases of caseous lymphadenitis in guinea pigs have originated from taking soil from night camps and infecting cuts with this material.

Our opinion still is that for the most part infection takes place during shearing and crutching, from ruptured abscesses, pus-infected wool, &c. In addition, there is a distinct possibility of infection of wounds made during shearing or crutching by the contaminated dust and surface material of sheep-yards and night camps, or by actual contact with infected sheep crowded under such circumstances.

Every possible effort should be made to segregate affected sheep, before shearing, in order to limit the dissemination of infective material.

CONTROL OF RAGWORT ON GRASSLAND.

THE SPRAYING AND DRY-DUSTING METHODS OF USING SODIUM CHLORATE.

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THE control of ragwort is at present exercising the minds of a great many farmers, particularly in Taranaki and the Waikato district. It is quite evident that although a large number of farmers are able to, and do, keep this pest under control, there are many others who for want of finance or from indifference fail to give it proper attention, and it becomes a great source of trouble to their neighbours. The great importance of proper control, particularly in the dairying districts, must be evident to every thoughtful person. Many means have been adopted by different people, but I propose to confine my remarks in this article to the more efficient use of chlorates, particularly sodium chlorate.

I think it can be definitely accepted that where sodium chlorate is properly applied it will give 100 per cent. of kills in the plants actually treated. It is, however, difficult to treat all the plants in a field at one dressing, and areas have to be gone over very carefully several times in the season if all plants showing are to be killed. This, unfortunately, is not always done. Frequently a farmer will treat the main crop, but leave a few plants to seed and keep up the supply. Even where the farmer is extremely careful and treats all plants showing there will be a fair number the following season. These are produced from seed already in the ground, or from seed introduced from neighbouring farms either by wind or stock.

It is not known definitely how long ragwort seed will remain viable in the ground, but a careful experiment to endeavour to determine this point is under way close to Palmerston North. A field of 4 acres in extent, and so situated that it is not likely to be freshly contaminated from outside, has been selected. In December, 1930, this field was badly infested and took two full days to spray. This spraying was carefully followed up during the autumn of 1931 and any odd plants treated, and it can be definitely stated that no plants were allowed to seed. Several inspections were made of the area during the spring of 1931 and the autumn of 1932. A few small plants were found and about one hour was spent in treating them. Again, it can be definitely accepted that no ragwort was allowed to seed. The winter and spring of 1932 were comparatively dry, and in the spring quite a number of young ragwort plants came away; during the late spring months of 1932 and autumn of 1933 it took about three hours' work to destroy these growing plants, or about three times as long as the previous year. Again no plants were allowed to seed. It remains to be seen how long ragwort will persist in this field.

During the past two years various forms or mixtures of chlorates have been tested, and the results show definitely that sodium chlorate is still the most efficient and economical to use. It has been further

proved that where the plants are nearing the flowering stage, or are in that stage, a 2-per-cent. solution sprayed on is quite strong enough to give 100 per cent. of kills.

Relative Merits and Incidence of the Two Methods.

During the past year considerable controversy has taken place as to the relative merits of spraying or of applying dry with a spreader such as carbonate of lime, rock phosphate, pumice, &c. I do not think it can be said that any one system is best, as each has particular merits under certain conditions.

The method of spraying has been fully explained in previous articles, but information on what is known as the dry method may be given here. This is a dusting of the plants with the powdered sodium chlorate, mixing it with a spreader to get bulk. Using powdered sodium chlorate alone, while very effective, is too expensive; consequently various spreaders have been tried, and several of them used extensively with considerable success. Almost any material will do, so long as it is fine, dry, and does not contain any organic matter. In practice carbonate of lime (ground limestone) or ground rock phosphate have given the most satisfaction, and carbonate of lime, being cheap, takes pride of place. The procedure is to thoroughly mix a given quantity of sodium chlorate and lime, and then apply this to the plants.

Some people are inclined to be dogmatic as to quantities to mix and apply to the land, but this is really a very open question. The whole point is that it is necessary to have the mixture strong enough to ensure a little of the sodium chlorate coming into contact with each plant. For instance, if one is applying the mixture in the same way as top-dressing—that is, endeavouring to cover the whole area with the mixture, and putting on from 5 to 6 cwt. per acre—then a strength of about 5 per cent. of sodium chlorate is necessary. On the other hand, if only the noxious plants are to be treated, it will be found an advantage to make up the mixture at a strength of from 8 to 10 per cent. and apply. If this is done carefully it will be found that 2 cwt. to 3 cwt. will be sufficient to treat a badly infested acre. A little more time will be required, but there will be a considerable saving in the quantity of the spreaders required, and—which is very important—the grass will not be burnt to the same extent as where the material is put on broadcast.

The broadcast method is necessary where land is so badly infested with small plants that practically the whole surface of the land is covered, and likewise where it is desired to give the land a dressing of lime — always provided the work is done when the plants are in the rosette stage, and in any case not later than the end of November. This is important, as the grass burnt at this stage has a chance to recover before the dry weather sets in.

An important question crops up here, and this is whether land so badly infested should be treated with sodium chlorate to clean it up. This depends on the nature of the land. If it is hill country and unploughable there is no alternative, but, on the other hand, if the land is ploughable it should be broken up and put into a good sole of grass, and the ragwort plants treated as they come up. The ploughing and cultivation will destroy most of the existing plants, but there will be

large quantities of seed in the land and a number of these seeds will germinate, and it is the plants from these that will have to be treated. Experience has shown that this is the best procedure. It has been advocated by some that when one decides to break up a field infested with ragwort it should be treated prior to ploughing so as to destroy the existing plants. This is surely an unnecessary expenditure, seeing that the cultivation will destroy the plants in any case and the treatment will not have any effect on the seed in the ground.

For broadcasting sodium chlorate when mixed with a spreader several methods have been used. When the ground has been cultivated and is reasonably level the fertilizer distributor gives every satisfaction, but for unploughed land and hill country a bag top-dresser of the Howell or Parker type will be found very suitable.

A careful trial was carried out in Taranaki during the past season to determine the relative costs of spraying versus dry treatment. An area very badly infested with ragwort was selected, and various treatments were applied on 19th December, 1932, as set out. The cost of labour and material in each case was as follows :—

	£	s.	d.
(*a*) 1 acre, sprayed with a 5-per-cent. solution—			
24 lb. sodium chlorate at 4½d. per pound	0	9	0
Labour, 8 hours at 1s. 6d. per hour	0	12	0
Total	1	1	0
(*b*) 1 acre treated with carbonate of lime and sodium chlorate put on as a top-dressing—			
5 cwt. lime at 25s. per ton	0	6	3
28 lb. sodium chlorate at 4½d. per pound	0	10	6
Labour, mixing, at 1s. 6d. per hour	0	1	3
Labour, spreading, at 1s. 6d. per hour	0	1	6
Total	0	19	6
(*c*) 1 acre treated with Nauru phosphate and sodium chlorate—			
3 cwt. Nauru phosphate at £4 5s. per ton	0	12	9
28 lb. sodium chlorate at 4½d. per pound	0	10	6
Labour, mixing and spreading, as in (*b*)	0	2	9
Total	1	6	0
(*d*) 1 acre treated with basic slag and sodium chlorate—			
3 cwt. basic slag at £5 per ton	0	15	0
28 lb. sodium chlorate at 4½d. per pound	0	10	6
Labour as for (*b*) and (*c*)	0	2	9
Total	1	8	3

An inspection of this area on 10th March showed the following results :—

(*a*) A complete kill—only one plant being found ; a splendid green growth of grass and clover. It was hard to believe the land had been badly infested with ragwort in December.

(*b*) A fairly good kill, probably 95 per cent., but ground still showing brown from the burning effects of the sodium chlorate. It was noted that a few plants had evidently been missed when top-dressing.

(*c*) Much the same as (*b*), except that there was more growth, and the area was greener, no doubt owing to the fertilizing effect of the phosphate.

(*d*) Similar to (*c*), except that the area showed more growth and was greener owing to the fertilizing effect of the slag.

The costs for labour will vary considerably, depending on the nature of the land and the energy or skill of the operator, and those given above can be taken as a guide only.

A further 12½ acres of the same farm were treated with carbonate of lime and sodium chlorate at the rate of 5 cwt. per acre on 24th March, part being applied by machine and part by hand. The machine-dressed area appears very clean at present, but the hand-dressed portion shows a few patches that were evidently missed. Careful records of cost were kept, and are as follows :—

	£	s.	d.
3 tons lime at 25s. per ton	3	15	0
3 cwt. sodium chlorate at 45s. per hundredweight ..	6	15	0
Labour, mixing and spreading, 26 hours at 1s. 6d. per hour	1	19	0
Total	12	9	0

(Or 19s. 11d. per acre.)

These figures approximate very closely those of area (*b*) in the former experiment.

The dry method, although practised for the last three years, has greatly extended during the past season, and great credit is due to Mr. W. E. Cayley Alexander, of Pio Pio, for the energy and persistent manner with which he has advocated this system. It is quite evident that the dry system will continue to expand and in many places entirely take the place of spraying. This being so, some notes on spreaders and methods of mixing will be of interest.

Spreaders and Mixing for Dry Method.

Spreaders.—As already mentioned, any material, so long as it is dry and fine enough and does not contain any organic or sulphurous matter, is suitable as a spreader. The reason why substances containing sulphur or organic matter are not suitable is the danger from explosion when they come into contact with the sodium chlorate. A number of farmers have mixed sodium chlorate and superphosphate and applied it as a top-dressing with excellent results and no detrimental effects. Bonemeal must not be mixed with chlorate, owing to the fact that it contains organic matter. On the other hand, carbonate of lime, rock phosphates, basic slag, pumice, &c., appear fairly safe owing to the absence of organic matter or sulphur.

Mixing.—The importance of thorough mixing when using sodium chlorate in conjunction with a spreader cannot be too strongly stressed. The sodium chlorate should be thoroughly incorporated with the lime, so as to ensure that very small quantities of the spreader dusted on to a plant are sure to contain some chlorate. Sodium chlorate is obtained in two forms — powder and crystals. As far the larger quantity is obtained in the powder form, I shall for the present confine my remarks to this. Powdered sodium chlorate, as usually sold, contains a considerable number of lumps and large particles, and before mixing with the spreader it is necessary to sieve out these lumps and crush them to the powder stage. Fine wire sieves suitable for this purpose can be bought, or one can be made. Mr. Cayley Alexander reports that a very suitable sieve can be made from the drum in which the sodium chlorate is received. He cuts it down to a handy size and punches suitable holes in the bottom.

Having reduced the sodium chlorate to a fine powder, it may be mixed with the spreader. For small quantities the required weight of spreader and sodium chlorate may be weighed out and thoroughly mixed, but for larger quantities the following procedure is recommended: Where a ton is to be mixed, or some similar definite quantity, take the amount of sodium chlorate required for the whole mixing and thoroughly mix this with an equal weight of the spreader. When this has been done this mixed material may then be mixed with the rest of the spreader. The mixing may be done with a shovel on the same lines as mixing cement or grass-seed.

A Waikato farmer having received his sodium chlorate in the crystal form, and being faced with considerable difficulty in reducing it to the powder form for mixing with the spreader, hit on the idea of dissolving the sodium chlorate in water and spraying it on to the spreader. He took 2 lb. of sodium chlorate, dissolved it in 12 pints of water, and sprayed this on to 1 cwt. of carbonate of lime. He reports excellent results, but is of opinion that owing to the better distribution of the sodium chlorate, 1 lb. of that material to 1 cwt. of lime would have been ample.

I have not had an opportunity of putting this method into actual practice, but it should prove excellent. Although not able to test the mixture on ragwort plants I have mixed up several lots of sodium chlorate and lime, and find that if reasonably carefully applied about 10 pints of water will thoroughly moisten 1 cwt. of lime. When the mixture has been prepared it should be spread out for a few hours to dry so as to facilitate spreading.

Summarized Points and Recommendations.

(1) Sodium chlorate is still the most efficient known method of controlling ragwort.

(2) If sodium chlorate is properly applied it gives a 100-per-cent. kill.

(3) The liquid spray method is the most efficient provided water is handy; less sodium chlorate is required per acre, and consequently a saving in cost of material is effected. On the other hand more labour is required.

(4) The liquid method is the dirtier from the operator's point of view. Where carelessness is shown clothes get badly saturated with the material, and when these clothes become dry there is grave danger from fire.

(5) The dry method is the cleaner, and if care is taken to thoroughly shake the clothes at the end of each day's work the fire risk is greatly reduced.

(6) More sodium chlorate is required per acre with the dry method, but less labour; consequently where labour has to be paid for the actual cost will not vary much as between each method.

(7) The dry method has a distinct advantage in that the mixture may be prepared any time and kept in store until required. I have recently used some that had been mixed for several months, and it is in the same condition as the day it was mixed.

(8) The dry method is excellent where only a limited quantity of ragwort is present on the farm. The farmer can have a quantity of

the material mixed, and any time he goes about the farm he can take a little and dust any plants seen. A tin with a few holes in the bottom and used as a shaker is very suitable for this purpose.

(9) The dry method is more effective when the plants are in the rosette stage; a light dusting at this stage is all that is required. If the plants are allowed to run up to flower large quantities of material are required. At this stage spraying will be found more effective.

(10) If ragwort has reached the budding or flowering stage and the land is level and clear enough, it will be found that it is cheaper and more effective to cut the ragwort down and dust the stubble. This method has proved very satisfactory.

(11) Where broadcasting is proposed, the work should be carried out not later than the end of November—in October for preference. If done at this time the burnt grass has a chance to recover. If broadcasting is adopted later in the season there is a great chance that a good deal of burnt grass will not recover until the autumn, and if very dry it is possible that a lot of it will be killed.

(12) It is recommended that the actual plants be treated rather than that the whole area be dusted. This will take a little longer, but will pay in the saving of material and pasture.

(13) Broadcasting should not be done between November and March unless the field can be done without until the autumn growth; even then there is a danger that the stand of grass will be considerably thinned out.

(14) If ploughable land is so badly affected with ragwort that the whole surface has to be treated, it is better to plough and reseed, following up by the treatment of plants that appear in the new sward.

(15) If unploughable land is so highly infested as to necessitate the treatment of the whole surface, it may not pay to treat with sodium chlorate. In such cases control by sheep should be adopted as a general practice, and the odd corners where sheep do not graze can be treated with sodium chlorate.

(16) The dissolving of sodium chlorate in water and then spraying on to the spreader would appear to be the easiest and most effective method of mixing for dry use.

(17) Where carbonate of lime can be procured at a reasonable price it is the best spreader. It should be ground as fine as possible.

(18) Waterproof clothing or overalls should be used when spraying, and be washed over at the end of each day. If ordinary clothing gets saturated with spraying material, it should be thoroughly washed in several waters before being allowed to come into contact with fire; otherwise there is considerable risk of burning.

(19) When using the dry mixture an endeavour should be made to remove all material adhering to the clothes and boots before leaving the field that is being treated.

Hoary Cress.—By Order in Council gazetted on 13th July the plant hoary cress (*Lepidium draba*) is included in the Second Schedule of the Noxious Weeds Act.

ESTABLISHMENT AND MANAGEMENT OF PERMANENT PASTURES ON THE LIGHT LANDS OF THE CANTERBURY PLAINS.

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THE results of four years' study of pastures on light land in Canterbury are embodied in this article. Numerous observations on the establishment and management of many pastures, supplemented by grazing records, crop costs, and farm accounts, form the basis of the conclusions which have been reached. The work has been directed by Canterbury Agricultural College, with the assistance of a special grant from the Department of Scientific and Industrial Research.

The subject is treated under the following heads: (1) Present position; (2) control of present grass covering; (3) use of better species of grasses, (*a*) perennial rye-grass, (*b*) cocksfoot, (*c*) red clover, (*d*) white clover; (4) methods of pasture establishment; (5) seed mixtures; (6) top-dressing; (7) harrowing; (8) good permanent pastures and their effect on the management of the farm; (9) cleaning brown-top areas and fitting in permanent-pasture establishment. An appendix gives an account of a top-dressing trial on poor pasture on light land in Canterbury.

1. THE PRESENT POSITION.

The establishment and management of permanent pasture is one of the most neglected aspects of farm management on the light lands of the Canterbury Plains. It is not difficult to find an explanation. It is a widespread and firmly fixed belief that these light lands will not "hold" good English grasses. Consequently there has developed a system of arable sheep-farming which could be carried on profitably so long as high prices were obtainable for sheep products as well as for cash crops such as oats, chaff, wheat, stripped rye-grass seed, red clover seed, and for winter grazing of sheep on turnips. Since the pastures were to be ploughed up within a few years for other crops little attention was given to the satisfactory establishment of grass, ease and cheapness being the prime considerations.

Even though the production of these temporary pastures and supplementary feeds fits in well with profitable crops of oats and wheat, so that teams and tractors are kept occupied the whole year, the high proportion of run-out pastures waiting to be ploughed is always a problem. Unfortunately, the temporary pastures are even more temporary than is desirable, so that they run out a year or two before it is possible to plough them again without serious disturbance of the farm organization. This period of low production has a double disadvantage. It reduces the income and allows weed invasion to occur. This state of affairs must be changed to one in which the farmer is reluctant to plough any of his good permanent pastures for such crops as those mentioned above.

The methods of cropping employed have often been detrimental to the soil fertility, and where areas have been badly farmed or "cropped out," brown-top (*Agrostis* sp.) has invaded. To-day the greater portion of the light lands is infested with brown-top, which in places forms dense turfs and swards of unpalatable, old-standing roughage. In certain areas, particularly towards the foothills, sweet vernal (*Anthoxanthum odoratum*) also forms a large part of the grass covering. In other areas creeping fog (*Holcus mollis*) is quite prominent. Chewings fescue and danthonia are present in some localities, while trefoil and hair-grass grow on almost all light lands. On many farms there are large areas of brown-top and/or run-out pastures, and on others the extensive cropping may have reduced the twitch but increased sorrel and yarrow.

At present it is the practice to sow down pastures in association with rape, kale, turnips, green-feed oats, chaff or grain oats, and over oats or wheat in the spring. A complete sward is rarely secured. Weeds soon invade, and the temporary rye-grasses die out in a year or two. Until recently the rye-grasses obtainable have been mainly temporary types, and it is the continued use of such grasses which has helped to foster the belief that light lands will not "hold" grass.

Cocksfoot is often sown in grass mixtures, but, under the excessive trampling, smothering, overgrazing, and indifferent management in the first year, it does not get a fair chance to become a useful constituent. There are exceptions to this. Here and there good stands, seven or eight years old, are growing successfully on light lands. Permanent rye-grass swards, six or seven years old, are also to be found.

The successful farming of these areas at the high rental to which they have been raised during good times is greatly dependent upon a recovery in prices. Apart from rent reduction and prices, however, if the best results are to be obtained, management is the most important factor, and from the pastoral aspect must include (1) control of the present grass covering, (2) introduction of better species of grasses and their proper grazing management, (3) proper pasture establishment, (4) economical seed mixtures, and (5) economical top-dressing.

In the following pages perennial rye-grass pastures and cocksfoot pastures are discussed. It is necessary to realize that such pastures are mixed, and that the perennial rye-grass or the cocksfoot is the dominant species in the sward. Pastures of pure species for grazing purposes are not recommended, though red clover may be an exception.

2. Control of Present Grass Covering.

The first step towards efficient pasture management on the light lands of the Canterbury Plains is full utilization of the present cover. Control of a grass like brown-top, especially in the unpalatable mature stage, is difficult, since sheep grazed even on apparently ample brown-top herbage may lose condition.

Spring burning offers a satisfactory means of control for brown-top, Chewings fescue, or danthonia roughage. After a good burn, fresh green

spring growth comes away, and if this is subjected to controlled grazing there will be no undue accumulation of roughage. Dry sheep are particularly useful for this purpose. They may be used alone or as followers to ewes and lambs in order to graze the field bare periodically.

Farms on which most of the grass covering consists of brown-top, &c., should carry some dry sheep. If all lambs cannot be fattened some can be kept and carried over as ewe hoggets. If all lambs can be fattened, then the purchasing of suitable ewe hoggets would be the most economical practice at to-day's prices. If these brown-top pastures are controlled by proper grazing it is possible to grow good store lambs and even to fatten some on the mothers. Many examples of 5 per cent., 10 per cent., and higher percentages of lambs fat off the mother are on record. If fields are numerous enough and there are several mobs of ewes and lambs, one or two of them should be kept on the same class of feed. They are then more contented than when shifted from good grass to poor. This also allows the mob or mobs grazing on good grasses a better opportunity of producing fat lambs off the mother.

Cattle are useful in roughage control if they can be carried economically. Large numbers of cattle are not recommended, but a few young steers can often utilize feed that would otherwise have to be burned. If cattle are fed on turnips and run off on brown-top effective control of the latter is often achieved.

Such brown-top pastures used as a run-off for sheep and cattle rationed on turnips or green-feed are well bared during the winter and enriched by the droppings. As holding paddocks when hand feeding is necessary these old pastures are excellent, as the turf is improved rather than damaged. The permanency and freedom from costly renewals, as well as the ability to stand severe grazing in dry weather and excess tramping in winter, are advantages of these old pastures which must not be overlooked.

There is no known economical treatment for permanent brown-top, danthonia, and hair-grass swards other than the burning and grazing management outlined. Skim ploughing when teams are not otherwise employed results in fresh green growth in the spring, which is relished by stock, but the practice leaves a rough field and its use appears limited.

3. Use of better Species of Grasses.

(*a*) perennial rye-grass.

It has been generally believed that perennial rye will not remain permanent on these light lands, but experiments conducted by the Department of Agriculture and by farmers themselves show clearly that true perennial rye is permanent when properly established, manured, and grazed. Evidence from various light land farms shows definitely that permanent perennial rye-grass swards, three and four years old, are still highly productive, while six and seven-year-old rye-grass swards without any special manurial treatment are still in fair condition. Such swards, though they appear to be slightly less palatable than the temporary type in its first year, are still highly nutritious. They produce more feed than the temporary or Italian type over a two-year period, carry considerably more stock than does

brown-top, and grow well in the late autumn, spring, and early summer. At the first dry spell, however, the permanent rye-grass shoots to seed. Its dry weather production and carrying capacity, therefore, is low, but it is the quicker to respond to autumn and winter rains.

The carrying capacity of perennial rye is greater than that of cocksfoot on medium and better-class light lands. A comparison of three-year-old permanent rye-grass fields with seven-year-old cocksfoot fields on the same farm and on similar medium light land, all rotationally grazed, gave the results shown in the accompanying table. Hair-grass, trefoil, and white clover covered about 40 per cent. of the ground in the cocksfoot pastures, while red clover, trefoil, and white clover covered about 30 per cent. in the rye-grass pastures.

Carrying Capacity per Acre.

Pasture.	Ewes and Lambs. 1 Sept. to 31 Jan.		Dry Sheep. 1 Feb. to 31 May.		Dry Sheep. 1 June to 31 Aug.	
	1930–31.	1931–32.	1931.	1932.	1931.	1932.
Perennial rye-grass (four fields)	3·30	3·59	2·01	..	2·24	..
Cocksfoot (three fields) ..	2·66	2·70	1·56	..	0·87	..
Difference (+) in favour of perennial rye	+0·64	+0·89	+0·45	..	+1·37	..

Since both pastures were rotationally grazed there was no cocksfoot roughage for summer or autumn feed.

On light land it is common for whole fields of perennial rye-grass to be completely ruined by the grass grub. The attack is worse in some seasons than in others, and so far no grazing or other treatment has been able to prevent it. This means that the proportion of the farm that can be sown in permanent perennial rye-grass in areas subject to grass-grub attacks is necessarily limited. No farmer can afford to run the risk of having the greater portion of his permanent pastures ruined, even in good seasons and prosperous times.

On very light scrub country, which scarcely pays for ploughing, perennial rye-grass may be less productive than cocksfoot, which should be dominant in most of the permanent pasture on it. It is here that subterranean clover may have considerable value.

(*b*) COCKSFOOT.

Cocksfoot, on account of its permanency and comparatively high summer production, deserves greater consideration on the light lands of Canterbury. The neglect of so valuable a herbage plant can be explained only by the former unsatisfactory methods of establishment and grazing. It has been the practice to sow it always with some cover crop or supplementary feed. The cocksfoot, if not tramped out during the subsequent feeding off, was either eaten out, or practically smothered in the first year or two by strong growth of temporary rye-grass and red clover. At the end of the second or third year when the competition was reduced scattered plants of cocksfoot

did well, but the field could not be left on account of the high proportion of bare ground and weeds with brown-top invading.

In certain areas and on several farms 8 lb. or 10 lb. of seed per acre have been sown with turnips in December. This allowed over seven months for the plants to become established, and in conjunction with other factors such as a poor turnip crop, little rye-grass, or a short winter grazing period, a reasonably fair cocksfoot stand developed by the second year and was allowed to remain. Failures with cocksfoot establishment which farmers relate can generally be attributed to methods that were unsatisfactory in some way or other. Sometimes the seed sown may have had a low germination.

Cocksfoot has one advantage over perennial rye-grass—it can withstand grass-grub attack reasonably well. Fields of strongly established cocksfoot which have been attacked showed that the cocksfoot, though weakened, recovers, while all plants of perennial rye-grass, hair-grass, and most of the red clover are destroyed. Under certain conditions cocksfoot grows better after the grass grub has been through the field. This may be explained by the removal of all competition, the long spell from grazing usually allowed a a field under such conditions, and the cultivation or tilth improvement brought about. In young cocksfoot stands the attack can be more severe than in old.

If spelled in the spring or early summer, cocksfoot produces a volume of feed which, although it may be of coarse leafage for sheep feed, carries dry sheep excellently in droughty summer weather. A cocksfoot field saved for such periods can be of the greatest value. Throughout the spring dominant cocksfoot pastures may be rotationally grazed to advantage, provided that sufficient spelling is allowed between the grazings during the following summer and autumn. Ewes and lambs rotationally grazed on this type of pasture during the spring and summer period thrive well. Up to 92 per cent. of fat lambs off the mothers have been secured on such pastures.

The best grazing management of cocksfoot is somewhat different from that of perennial rye-grass. The intervals between the grazings need to be longer and the grazings should not be so close, especially in the early growing season, or in dry weather. *Periodically the pasture should be given fairly lengthly spells to enable complete renewal of the plant crown, which does not resist well continuous controlled grazing.*

Where large flocks of sheep are wintered on turnips, green-feed, and dry supplementary feed, a holding paddock of cocksfoot benefits considerably from hoof cultivation and from the urine and droppings that accumulate, provided that such tramping is not excessive. The fullest benefit is obtained if the field is shut up a few weeks before the normal spring growth commences, and is allowed to produce a fair leafage growth before being grazed again. Perennial rye-grass, of course, benefits similarly. On the other hand, if in winter sheep are shut on a cocksfoot field and are not provided with sufficient supplementary feed the cocksfoot plants, more particularly the crowns, are severely treated. Where a cocksfoot field has been

allowed to grow to short roughage for "supplementary" summer feed, and where the crowns of the plants have grown above the ground, continuous winter grazing can easily be too severe on the cocksfoot. The soiling of the pasture with a large flock running off turnips or green-feed, together with the more palatable feed, seems to prevent that harmful close nipping. Old sheep with poor teeth cannot do as much damage as young ones.

The value of cocksfoot pastures on light land lies not only in their resistance to grass-grub attack, but also in their late spring and summer production. When perennial rye-grass is shooting to seed, and leaf growth has stopped, cocksfoot is still producing green leafage. Where a good mixture of red and white clover is associated with cocksfoot-dominant swards excellent lamb-fattening feed may be available in normal seasons until the end of January. If the pasture has been spelled in November and December, and not grazed hard in January, such feed, though in the wilted form, may be secured even in February. Red clover is especially useful in this way, but as it lasts only three years or so in any quantity, white clover has commonly to be relied upon. Although the total yearly production is greater from dominant perennial rye-grass than from dominant cocksfoot pastures, the latter are worth growing because they provide a cheap summer reserve.

(*c*) RED CLOVER.

One of the highest summer-producing herbage plants is red clover. Unfortunately, the economic value of lucerne on these dry light lands has not yet been established, so that of the legumes red clover alone remains as a high summer producer. Red clover is not a prolific grower in dry weather, but it produces a great volume of feed during the late spring. Although this clover is slightly unpalatable in the earlier spring it is excellent sheep feed in the dry weather, and will even fatten lambs during the summer and autumn. Red clover will continue to grow when perennial rye-grass has completely stopped growth, so that in the early part of a dry period when the temperatures are high this plant does well. In prolonged dry conditions, however, it ceases growth, but is exceedingly useful in the wilted or dried form as a first-class sheep feed.

The proper grazing management of red clover has not been given sufficient consideration. The best yields of leafage are obtained by controlled grazing, with long intervals between the grazings. Red clover, therefore, should not be grazed until very late in the spring, then eaten down quickly to a moderate extent, and allowed to come away again. This eating down may occur several times during the spring, but if a large volume of feed is desired for a summer reserve, or lamb fattening feed, the field should be shut up reasonably early. It may be that the red clover field requires only one grazing down during the spring period.

Red clover is usually mixed with other pasture plants, and being unpalatable in the growing stage is more or less neglected throughout the early spring, when the other grasses such as perennial rye and cocksfoot may be eaten quite short. In this way the red

clover acts as a partial reserve for a dry period. Although it is common to see fields of perennial rye-grass and red clover with the rye-grass eaten quite bare and an abundance of red clover scarcely touched, it is eaten quite short throughout the spring period where brown-top or other unpalatable species constitute the bulk of the herbage. At present on the average farm it is this red clover reserve that helps to carry the sheep when a dry "pinch" comes at any time during the spring or summer. Dominant red clover pastures properly handled, then, could profitably assist in such times of scarcity for ewes and lambs, lambs alone, old ewes, or by providing winter reserves in the form of hay or ensilage. The fattening of lambs on red clover, alone or with a ration of wheat grain, may be practised.

Red clover properly handled gives abundance of summer feed on these light lands. Red clover pastures have been made to last three or four years under proper grazing treatment.

With the exception of the winter period, when turnips, chaff, &c., are the main feeds, grazing can be available to sheep at all times. During a prolonged drought these pastures will, of course, cease to provide ample feed. Any other crop will also cease growth. This feed is obtained from improved or newly sown permanent pastures. Perennial rye-grass provides autumn, winter, and spring feed. Cocksfoot and red clover provide spring, summer, and autumn feed. Red clover has its greatest use as a high-quality summer reserve.

(*d*) WHITE CLOVER.

At present trefoil fills up an open sward during wet weather on any light land pasture. It has some value on this account, but white clover should occupy its place. The spring and summer production of this plant are higher than that of trefoil, and permanent high-producing strains have recently been made available. Although white clover will not produce in the dry weather its association with permanent rye-grass, cocksfoot, and red clover swards in giving high spring carrying capacity, is useful. The part it plays as a constituent of these swards in the production of lambs fat off the mothers cannot be overlooked. When properly stocked and grazed it is an important fattening feed in December and January, and in some seasons even in February.

(To be continued.)

Harvesting of Field Peas.—Mr. J. G. McKay, Fields Instructor, Christchurch, reports: "In the Lincoln district it is a fairly common practice when cutting heavy crops of peas, with the side delivery, to have a strong scythe blade fastened (with the cutting edge uppermost) to the divider, with the point facing towards the platform and at an angle which will allow the haulms to pass up readily to a position where they are pressed down by the reel arms to be shorn off, and thus leave a perfectly straight face on the uncut crop. The advantages of such an attachment are fairly obvious to any one who has had anything to do with harvesting peas in this way."

BARLEY FOR POULTRY FEEDING.

COMPARATIVE EXPERIMENT WITH WHEAT.

H. A. KITTO, Overseer, Wallaceville Poultry Station.

WHILE wheat has long been generally regarded as the staple grain food for poultry, its cost and quality as compared with other cereals determines the extent to which it can be profitably used. It is now well recognized that the feeding of the ration which produces the greatest margin of profit over cost of production should be the object aimed at, rather than the ration which gives the highest egg yield but at a greater cost and with consequently less profit. With this in view, an experiment designed with the object of gaining some first-hand knowledge regarding the value of barley for promoting egg production, as compared with wheat, when included in a ration for laying fowls, was conducted recently at the Wallaceville Poultry Station.

The test covered eighty White Leghorn pullets of the same age and strain, which were selected as uniformly as possible in regard to type, size, and points indicating constitutional vigour. Two adjoining houses of the same size, and of similar design in all respects, were utilized for the experment, forty birds being placed in each.

The eighty birds after selection were accommodated in one house for several days, during which time a similar diet was provided for all the birds, both whole wheat and barley being included in the grain ration. In this way all the birds intended for the experiment were afforded an opportunity of eating barley, which had not previously been made available to them.

Following this procedure, forty of the birds were run through to the adjoining house, each lot being thus in possession of the respective quarters they were intended to occupy during the period of the test. In short, all possible was done to ensure that both lots of birds would commence the test under identical conditions. As a matter of convenience the barley-fed birds will be designated Lot 1, and those fed with wheat Lot 2.

During the experiment, which lasted over a period of forty-eight weeks—from 1st April, 1932, to 3rd March, 1933—both lots of birds received two mash meals a day, in the early morning and at midday respectively, the mash being moistened with boiling water. The evening meal consisted of whole grain. At each meal the birds were given all the food they could eat without waste.

The usual procedure carried out in experimental work of weighing and placing in separate receptacles sufficient food to maintain the birds for approximately ten days was adopted in this case, and any food left over at the end of this period was weighed back. The rations for the two lots were as follows :—

Lot 1.

Mash Mixture.	lb.	Whole Grain.	lb.
Barleymeal	32	Barley	100
Pollard	14		
Bran	18		
Meatmeal	7	(approx. 10 per cent.)	
Total	71		

Lot 2.

Mash Mixture.	lb.	Whole Grain.	lb.
Wheatmeal	32	Wheat	100
Pollard	14		
Bran	18		
Meatmeal	7	(approx. 10 per cent.)	
Total	71		

The following table shows the kind, the cost, and the amount of food consumed by each lot of birds during the forty-eight weeks :—

Table 1.

Foodstuffs.	Price.	Amount consumed.	Cost of Foods used.
	Lot 1.—Barley-fed Birds.		
	£ s. d.	lb.	£ s. d.
Barleymeal	8 0 0 per ton	640	2 11 2½
Pollard	6 11 4 per ton	280	0 18 4½
Bran	5 17 0 per ton	360	1 1 0½
Meatmeal	8 12 8 per ton	272	1 0 11½
Barley	0 3 10 per bushel	1,816	6 19 3
Total cost	..	..	12 10 10
	Lot 2.—Wheat-fed Birds.		
Wheatmeal	10 0 0 per ton	640	3 4 0
Pollard	6 11 4 per ton	280	0 18 4½
Bran	5 17 0 per ton	360	1 1 0½
Meatmeal	8 12 8 per ton	261½	1 0 2
Wheat	0 6 0 per bushel	2,040	10 4 0
Total cost	..	..	16 7 7

Table 2 shows the number of dozens of eggs laid each month, the average monthly price per dozen received, and the monthly proceeds.

Table 2.

Monthly Egg Yield, in Dozens.	Average Price, per Dozen.	Proceeds received Monthly.
	Lot 1.—Barley-fed Birds.	
	s. d.	£ s. d.
April, 1932, $31\frac{10}{12}$	1 11¼	3 1 8¼
May, $38\frac{1}{12}$	1 11	3 13 0
June, 51	1 8	4 5 0
July, $66\frac{7}{12}$	1 2	3 17 8
August, $66\frac{3}{12}$	1 1½	3 14 6¼
September, $66\frac{5}{12}$	0 10½	2 18 2
October, $70\frac{5}{12}$	0 10¾	3 3 1
November, $64\frac{10}{12}$	0 10½	2 16 8¾
December, $63\frac{10}{12}$	1 1¼	3 10 5¾
January, 1933, 58	0 11¼	2 14 4½
February, $48\frac{4}{12}$	1 1½	2 14 4½
March 3rd, $5\frac{4}{12}$	1 2½	0 6 4
Total amount received for eggs ..	..	36 15 5
Total cost of foodstuffs used	..	12 10 10
Total profit over cost of production ..	..	24 4 7

Table 2—continued.

Monthly Egg Yield, in Dozens.	Average Price, per Dozen.	Proceeds received Monthly.
Lot 2.—Wheat-fed Birds.		
	s. d.	£ s. d.
April, 1932, $20\frac{10}{12}$	1 $11\frac{1}{4}$	2 0 $4\frac{1}{2}$
May, $28\frac{4}{12}$	1 11	2 14 $3\frac{1}{2}$
June, 47	1 8	3 18 4
July, $58\frac{11}{12}$	1 2	3 8 9
August, $65\frac{3}{12}$	1 $1\frac{1}{2}$	3 13 4
September, $65\frac{3}{12}$	0 $10\frac{1}{2}$	2 17 $0\frac{1}{4}$
October, $71\frac{5}{12}$	0 $10\frac{3}{4}$	3 3 $11\frac{3}{4}$
November, $60\frac{8}{12}$	0 $10\frac{1}{2}$	2 13 1
December, $60\frac{10}{12}$	1 $1\frac{1}{4}$	3 7 2
January, 1933, $57\frac{7}{12}$	0 $11\frac{1}{4}$	2 13 $11\frac{3}{4}$
February, $42\frac{8}{12}$	1 $1\frac{1}{2}$	2 8 0
March 3rd, 4	1 $2\frac{1}{4}$	0 4 9
Total amount received for eggs ..	..	33 3 $0\frac{3}{4}$
Total cost of foodstuffs used	..	16 7 7
Total profit over cost of production ..	..	16 15 $5\frac{3}{4}$

Table 3 gives a summarized statement of the experiment, covering the forty-eight weeks' period :—

Table 3.

Total Eggs laid and sold (in Dozens).	Amount received for Eggs.	Total Cost of Food.	Total Profit.	Cost of Food per Bird.	Cost per Dozen Eggs to produce.	Profit per Bird.	Average Number of Eggs laid per Bird for Test.
			Lot 1.—Barley-fed.				
Dozens.	£ s. d.	£ s. d.	£ s. d.	s. d.	d.	s. d.	
$630\frac{1}{12}$	36 15 5	12 10 10	24 4 7	6 $3\frac{1}{4}$	$4\frac{3}{4}$	12 $1\frac{3}{8}$	189·27
			Lot 2.—Wheat-fed.				
$582\frac{8}{12}$	33 3 $0\frac{3}{4}$	16 7 7	16 15 $5\frac{3}{4}$	8 $2\frac{1}{4}$	$6\frac{3}{4}$	8 $4\frac{5}{8}$	174·8

Notes on the Experiment.

Green stuff—chiefly silver-beet and succulent chaffed green oats—was fed daily and in abundance. In addition to the amount of meat-meal included in the mash mixture, this material was placed in separate receptacles and left before the birds to eat at will. By feeding the grain materials, green stuff, and animal food chiefly by themselves the birds were given an opportunity of balancing their own ration. Gravel grit and broken sea-shell were in reach of the birds at all times to pick at.

Throughout the experiment both lots of birds relished their food, and, with the exception of a few in each pen which went into a semi-moult shortly after the commencement of the test, they generally maintained a healthy vigorous appearance.

At no time during the test did the birds of Lot 1 show any dislike for barley; this appeared to be just as palatable to them as was wheat to Lot 2.

During September it was noticed that the birds in Lot 1 appeared to be declining in weight, and it was expected they would continue to get lighter and the egg yield would suffer as a consequence; but this did not prove to be the case, and right to the end of the test they maintained perfect health and continued to eat and lay well.

The most interesting observation made during the test, and one which is well worth investigating, was the sleek, active, and tight-feathered appearance which the birds of Lot 1 bore from September until well after the termination of the test. It may also be mentioned they were particularly late moulters in general.

The barley-fed birds stood out by themselves as compared with any other pens on the farm, a condition which was frequently commented upon by visitors. It is only reasonable to assume that the marked difference shown in the general appearance and feathering was due to certain elements obtained from the barley consumed.

Referring to the tabulated results, it may be mentioned that the cost of food consumed is based on wholesale prices delivered at the Poultry Station, and the values credited for eggs are those realized on the Wellington market. It will be noted that the cost of sea-shell and gravel grit consumed is not shown. It is estimated that the cost of these materials consumed would be from 10s. to 12s. for each lot of birds.

The egg yield of the birds of Lot 1 was far beyond our expectations. It will be observed that they laid 7,571 eggs, an average of 189·27 each for the forty-eight weeks. Lot 2 gave a yield of 6,992 eggs, an average of 174·8 per bird, or a difference in yield of 579 eggs for the same period. Eggs laid by Lot 1 cost 4¾d. a dozen to produce and 6s. 3¼d. to feed each bird for the forty-eight weeks, while the profit over the cost of food for the period was 12s. 1⅜d. Eggs laid by Lot 2 cost 6¾d. a dozen to produce and 8s. 2¼d. per bird for food, and returned an approximate profit over cost of food of 8s. 4½d. Lot 1 gave a profit of £24 4s. 7d. over cost of food, and Lot 2 £16 15s. 5¾d.

A second experiment on similar lines is now being carried out at the Wallaceville Station.

Cutting back Fruit Trees for Grafting.—The Orchard Instructor at Hastings, Mr. A. R. Grainger, reports: "An illustration of the danger in cutting hard back large trees for grafting purposes was recently noticed in an orchard in this district. About twenty-five very well grown Washingtons were cut back to about 4 ft. and Cox's Orange scions put on, and although there was a good take and they grew well for two seasons the whole lot are now being pulled out, owing to the ravages of silver-blight. There are many other such instances, and it appears that top working is not practised so frequently as it should be. One excellent instance of top working Packham's pears may be seen in another local orchard. Here, although the trees were worked at over 6 ft. from the ground, the lower branches have come down so that the fruit is harvested as easily as from trees which have been raised in the nursery."

RESEARCH ON PULPY KIDNEY DISEASE OF LAMBS.

SINCE 1927 this *Journal* has published articles briefly outlining the progress of the investigation being made by the Department of Agriculture into the disease causing mortality among young lambs commonly known as "pulpy kidney." The officer specially engaged in this work, Mr. D. A. Gill, of the Wallaceville Veterinary Laboratory (who contributed the articles referred to), has recently prepared a full technical report on the researches in connection with the disease, and this has been issued by the Department under the title of "Pulpy Kidney Disease of Lambs: An Acute Enterotoxæmia of Bacterial Origin."

The first part of the report contains all the information that has been gathered in an effort to discover what factors predispose lambs to the disease. It includes detailed observations on the pathology of the disease, a study of the conditions under which it occurs (epidemiology), and the effect of the various preventive measures that have been advocated. Particular attention has been paid to the way in which the wintering of the ewes (as reflected in their milk yield) affects the incidence of this disease among their lambs.

While no final conclusions have been drawn, there is much circumstantial evidence that digestive disturbances, generally occurring at the time that the lambs start grazing, are responsible, and that these are more apt to occur in lambs that are receiving an abundance of milk from the ewes and thriving rapidly. Hence the old and erroneous idea that the lambs were dying of "overnutrition." Exhaustive chemical analyses of the soil, pastures, and ewe's milk have shown that there is nothing of a qualitative nature that can be inimical to the lamb's well-being in these respects, but the ewes whose lambs die are generally giving more than the usual quantity of milk. The information contained in this section will prove of great value in further investigations, as it provides a basis that previously was lacking.

The second part of the report deals with the actual cause of the disease, and details the steps taken to prove that it is due to poisons formed in the lamb's intestine by a particular species of microbe. The microbe has been grown artificially, the poison it forms has been obtained from cultures, and this, by injection into lambs, has set up the disease. Moreover, it has been shown that the poison present in the intestine of affected lambs is not present in that of healthy ones, and by very delicate tests the poison in the lamb's intestine and that formed by the microbe in cultures have been proved to be the same.

An antitoxin (antidote to the microbial poison) was made, and its inoculation into a large number of lambs on affected farms during the spring of last year gave promising results. As Mr. Gill points out, however, such a means of prevention is too expensive for use in a general way, although it should be of great value in stopping outbreaks among lambs of more than ordinary value, such as in stud flocks.

It is hoped that further work on the factors, such as indigestion, which predispose lambs to the disease may eventually enable farmers to prevent it by some practicable change in the feeding or management of the sheep, and it is in this direction that further research is likely to be of most value. In the meantime, as Dr. C. J. Reakes, Director-General of Agriculture, says in a foreword to the report, "This work has robbed the disease of that air of mystery which was perhaps the main cause of anxiety on the part of sheep-farmers, besides, giving us, it is hoped, a means by which severe outbreaks among valuable lambs may be promptly checked."

SEASONAL NOTES.

THE FARM.

Bearing of Pasture Top-dressing on other Field Work.

AN important matter which requires some consideration at this season is the relation between judicious top-dressing and the provision of special feed for use during the periods of naturally low production from pastures. In the minds of many there seems to be a belief that top-dressing when skilfully exploited may be employed to level out to a material extent the production from grassland from season to season and thereby increase the amount of dependence which may safely be placed on pastures as a direct and immediate source of feed. Actually, as a rule, top-dressing of a type which is commonly accepted as economically sound intensifies the need for the provision of feed to supplement that which becomes immediately available from pastures from month to month.

During recent years this matter has been carefully investigated by the Department of Agriculture. The investigations indicate that fertilizers may be used profitably in a way which will bring about increased growth of grassland during winter and other periods of low growth, but the same investigations indicate further that the extra growth at slack seasons has not given any substantial assistance in bridging the awkward gap between the periods of high production and of low production of grassland.

As an illustration of this it has been found in experimental work that summer and autumn applications of superphosphate both roughly doubled the production of pastures during the period May to August. Such an increase in winter production expressed relatively in the above manner seems quite substantial. But the winter growth without top-dressing is so slow that the increased growth due to top-dressing when considered absolutely is not impressive. The point of special interest in the present connection is that while the same summer and autumn applications considered above had not nearly doubled the growth in the following late spring and summer, the increase obtained in the latter period, expressed in actual weight, was about five times as great as the winter increase. Hence such top-dressing, although it increased winter growth, actually widened the gap between the production of winter and that of late spring and summer. And this despite the fact that the comparative differences in the rate of pasture growth throughout the year were levelled out to some extent.

A greater levelling out in production of pastures may occur from similar top-dressing under milder climatic conditions than those obtaining in the experimental work under consideration; but conversely a smaller levelling out may occur under more severe climatic conditions, and so it is of moment that the conditions of the experimental work just considered approximate in essential respects to those obtaining in the major portion of those districts in which grass-farming is specially prominent.

During recent years a good deal of attention has been given to the use of nitrogenous fertilizers, such as sulphate of ammonia, for the purpose of stimulating growth during the off season of pasture production. Something can undoubtedly be achieved in this way, but it is strictly limited in amount. For instance, while application of sulphate of ammonia or similar nitrogenous materials in late July or August may be expected to stimulate growth in August and September, yet, as with phosphatic manures already mentioned, even if growth is doubled, the increase in feed thereby provided may be expected only partly to remove the shortage.

Further, nitrogenous top-dressing has been found not to greatly influence growth in May, June, and July. Hence the useful influence of nitrogenous top-dressing is considerably restricted in duration, and, while there is a possibility of employing nitrogenous fertilizer to lessen the gap between the periods of high and of low production, it normally may be expected to leave a large gap still to be bridged.

Good grazing management, especially in early summer, has been found of value in levelling out the rate of pasture growth throughout the year; but it cannot serve to affect materially the rate of growth in winter and early spring—the period most urgently calling for adjustment.

To sum up: The fundamental weakness in grassland as a direct source of stock feed is the occurrence of critical periods during which the rate of growth of pastures is relatively low. A system of grass-farming which depends wholly or principally upon top-dressing and skilful grazing management to remedy this weakness is intrinsically unsatisfactory in feeding stock, the economic production of which suffers from periods of shortage of feed—which is markedly the case with dairy cows and breeding ewes.

The only known economically sound way of having feed supplies to meet feed requirements from time to time throughout the year is along the line of practice such as ensilage and the growing of special crops, of which mangels, lucerne, chou moellier, carrots, and turnips are typical. The circumstances on certain farms may give rise to exceptions to this generalization; but these exceptions are so few as not to affect its validity as a statement of the grassland position in general.

Both ensilage and special cropping can be made potent in putting the stock-feed position on a sound basis from one end of the year to the other. They are not, as some seem to believe, rival means of attaining the one objective. In other words, as a rule, a farmer should not ask, "Is it better to use ensilage, or is it better to employ special cropping in order to make provision for periods of scarcity of feed from pastures?" Generally the best farm management consists in exploiting both ensilage and special cropping. Ensilage serving as a supplement, not as an alternative, to special cropping will in a great number of cases give more attractive results than ensilage alone or special cropping alone.

Seasonal Top-dressing.

The application of phosphates to a pasture shortly after it has been sown usually is sound economically. Under conditions of abundant rainfall the addition of a small amount—say, not more than 1 cwt. an acre—of quick-acting nitrogenous material to the phosphate may be worth while if cold conditions prevail. Such top-dressing tends to give the seedlings additional vigour, which is likely to assist them usefully in passing through the delicate young stage. It is to be noted that there is some ground for believing that the use of sulphate of ammonia on newly established pastures may deleteriously affect clover establishment. Such an effect is unlikely to be of moment in conditions which normally give a wealth of clover in swards; but when experience leads one to expect normally a scant content of clover, then any practice that may possibly reduce the clover should be viewed with caution.

Top-dressing in September of established pastures which have not as yet been dressed will secure extra growth; but such top-dressing cannot be recommended without reservations. If there is promise of an adequate supply of pasture growth for all requirements up to Christmas, including ensilage and hay, then the case for September top-dressing is definitely weak.

Generally fields which are to be set aside for silage or hay should be top-dressed just before they are closed from stock if fertilizer has not been

applied to them fairly recently. Such top-dressing is likely not only to increase both the quality and the quantity of the hay or silage, but also to reduce the cost of harvesting it on a tonnage basis.

Grass-grub Ravages.

When the majority of the valuable plants in a pasture have been destroyed by the grass grub, then the best course to follow almost invariably lies in putting the land under the plough so that the land may eventually be resown. In planning the resowing of pastures it should not be overlooked that grass or cereal crops cannot with safety follow immediately a grass or cereal crop which was attacked by the grass grub. If pastures showing signs of grub infestation are not so seriously damaged as to be beyond repair, then as far as practicable the feeding out of hay, silage, and roots should be concentrated on them. The feeding out of hay made from overmature herbage is at times particularly useful, for such hay often contains viable seeds of valuable species, and many of these seeds sown on the surface during the feeding of the hay establish themselves and materially thicken the sward.

Pasture Establishment.

Over a wide range of conditions pastures may often be sown successfully in September. Generally the most successful establishment takes place when the pasture is not sown with a companion crop, and should a companion crop be grown it is advisable, as a rule, to use a lighter seeding than would be used were the companion crop to be grown by itself. Permanent pasture in particular should be freed from injurious competition from companion crops, while short-rotation pastures may often with advantage be sown with such companion crops as oats or barley; but it should be remembered that the better the companion crop the poorer is the pasture likely to be. The shading effect of cereals on pastures is lessened if the cereal is harvested for silage or chaff, as the pasture is then subjected to the shading for a shorter period than if the cereal were harvested for grain, and the drain of the cereal crop on the summer supply of soil moisture is curtailed.

Pasture Seed Mixtures.

The prescribing of suitable mixtures of pasture seeds is not only of more than ordinary difficulty, but is also of fundamental importance. The use of an unsuitable mixture may readily lead to unnecessarily low returns from a field over a long period of years. Because it is relatively difficult the task of prescribing seed mixtures is at times too readily delegated to others, with no certainty that they possess both the knowledge and the desire to prescribe the most suitable mixture. Because the task is of prime importance, not only is this far from desirable but it is what at times leads to the use of very unsuitable seed mixtures, sometimes recommended honestly by persons who have not kept in touch with relatively recent developments in grassland work, and at other times recommended to suit the trade of those giving the advice.

Of outstanding importance is the use of suitable strains of the plants being sown. In this connection care requires to be exercised in respect to rye-grass, cocksfoot, and clover. Assurance that a good strain of rye-grass is being used can usually be obtained readily only by obtaining certified perennial seed. The merits of the true perennial rye-grass that is obtainable through the official system of certification have been so widely demonstrated that the relatively high cost of the certified seed has been in the past probably the main cause deterring farmers from using it generally. Lately the position in regard to supplies of certified seed has changed so substantially in favour of the buyer that there is no longer any real reason why certified seed should not be used practically always in New Zealand when perennial rye-grass is to be included in seed mixtures.

Except when there is likelihood that the sward being established will later be used for the production of seed, thoroughly satisfactory results may be expected from the use of certified seed graded as "permanent pasture" or as "permanent pasture first harvest." But when seed production is contemplated, the more expensive grade, "mother" seed, should be used.

In the past few years it has been customary to sow mother seed in the autumn and to harvest seed from the resulting sward in the following summer. Unless the fertility is very high this practice may have on the young pasture a detrimental effect which will have a prolonged depressing influence on its production. The sowing of mother seed in the spring and the harvesting of seed from the resulting sward in its second summer is likely to be a procedure which would lessen or eliminate the possibility of the detrimental effect just mentioned.

Certification takes into account only the type of plant which the live seeds are capable of producing and ignores the matter of viability of the seeds. In other words, lines of certified seed are not necessarily characterized by high germination capacity—in fact, some lines are known to be of relatively poor germination. At the completion of the certification of any line of seed an official statement is issued to the owner indicating the germination capacity as determined by official testing. All lines of certified seed, as well as of all other seed, should be purchased on the basis of their value, which is governed to a material extent by the germination capacity. In view of the fact that the original owners of certified seed have been notified officially what its germination capacity is, farmers should be able to ascertain readily the germination capacity of any particular line, even though that line may have changed hands a number of times. Quantities of certified clover and cocksfoot were harvested last season, but the supplies of clovers are relatively limited, and when it is not practicable to purchase certified seed the best available course is to use seed of New Zealand origin.

Fortunately, additions made to our knowledge during the past few years have so simplified the task of fixing the details of seed mixtures that one of three seed mixtures, with minor modifications, will suitably cover the requirements of the great majority of farmers who will be sowing down pastures at this season.

For permanent pastures, which are of greatest importance, Mr. E. Bruce Levy, Agrostologist, Department of Agriculture, has prescribed the following mixture as suitable for use over wide areas in both North and South Islands (all amounts being per acre): True perennial rye-grass, 20 to 25 lb.; New Zealand cocksfoot, 10 to 15 lb.; crested dogstail, 3 lb.; timothy, 3 lb.; New Zealand white clover, 2 lb.; red clover, 3 lb.

The smaller amount of rye-grass in this mixture is advisable when the summer rainfall is below that needed for good results with rye-grass, as under typical Canterbury and similar conditions; and under these conditions the larger amount of cocksfoot is advisable, as it also is when it would not be profitable to raise the fertility of the land up to rye-grass fertility requirements by top-dressing.

The following modifications to the mixture are likely to be advisable under the conditions specified:—

(1) On land which is of naturally high fertility and on which the permanence and good growth of rye-grass all the year round is assured, a mixture consisting of 40 lb. of perennial rye-grass and 3 lb. of white clover may be used, the other species being omitted. There is only a very limited area of such land.

(2) In many northern districts of the North Island paspalum at the rate of 6 lb. to 8 lb. an acre may advantageously replace cocksfoot.

(3) Poa trivialis at the rate of 2 lb. an acre should be included on high-class country which is damp in the winter.

(4) Meadow foxtail is a grass of high value on fertile swamps too wet in winter for success with rye-grass, and 6 lb. an acre should be included

for such conditions. But if it is at all practicable to drain the land and thereby make it suitable for rye-grass, this should be done and rye-grass sown.

(5) Strawberry clover at the rate of 1 lb. an acre may well be substituted for white clover on land too wet for the latter, and its use is also advisable for salty marshy conditions.

For temporary pastures of one or two years' duration a mixture which may be expected to give good results widely is: Italian rye-grass, 25 to 30 lb.; red clover, 6 lb.: total, 31 to 36 lb. per acre. The temporary pastures that such a mixture would provide are of considerable value both as a means of spelling land which has been impoverished by cultivation, and as a means of weakening or eliminating weeds, such as blackberry or tall fescue, prior to the sowing of a permanent pasture.

For short-rotation pastures which are intended to have a life of two to three years the mixture recommended is as follows: Italian rye-grass, 15 lb.; perennial rye-grass, 15 lb.; red clover, 4 lb.; white clover, 2 lb.: total, 36 lb. per acre. Short-rotation pastures are employed mainly on farms on which, largely because of climatic conditions, arable crops instead of pastures are the dominant feature.

General Cropping Work.

Last month's notes relative to cropping generally are applicable broadly to the work requiring seasonal attention. Provided weather conditions are suitable field work should be proceeded with as rapidly as possible; but more harm than good may come from the working of soils which are too wet.

The field carrot is a crop which is not grown as widely as its merits on good friable soils warrant. As evidence of this is the fact that in this year's farmers' field competitions in Taranaki the forty-four crops judged gave an average yield of over 50 tons an acre. Coupled with this is the further fact that the carrot has the greatest feed value per ton of the common root crops of the farm, being excelled only by the potato and the parsnip.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Cultivation.

It is obvious that many orchardists do not realize what an important part thorough and systematic cultivation plays in the annual production of fruit, otherwise one would not find so many uncultivated or partially cultivated orchards at this time of the year.

It was suggested in the April issue notes to plough as soon as possible after the leaves have fallen and before winter frosts have set in, by throwing a furrow up to each row of trees. This late autumn or early winter ploughing is the best time for turning in a cover crop. If there is no cover crop, there is almost bound to be an abundance of green vegetation, which, when turned in at this time, will, through the process of decay, help to keep the ground warm; while the action of frost on the turned up soil not only helps to sweeten, but pulverizes it as well, the benefit of which will be very noticeable during the necessary subsequent cultivation required to bring the soil to a fine tilth.

The second ploughing should be put in hand about this time (August) by striking out midway between the rows of trees, thus filling in the centre furrow made by the autumn ploughing. Continue

working up to within a reasonable distance of the trees. The land round the trees untouched by the plough should be dug or grubbed and vegetation (if any) turned under, or, better still, thrown out on the land where the harrows or disks will deal with it. A few strokes of the disks or harrows, when soil conditions are favourable, will suffice to bring the soil to a comparatively fine tilth, when the ground should be again ploughed before the drier weather sets in.

This third and final ploughing for the season is the best time for cross ploughing an orchard. Subsequent cultivation will consist of harrowing, &c., and should be continued until about the end of December or later if possible. On no account should weeds, grass, or leaves be allowed to remain round the trees, as such an accumulation supplies a breeding ground for black-spot, red-mite, and bronze beetle, &c.

Manuring.

The quicker-acting manures such as sulphate of ammonia, nitrate of soda, &c., may be applied about the beginning of September, according to the first signs of growth movement. Care must be taken, however, not to overfeed the trees.

Grafting.

No doubt those growers who contemplate reworking old and unprofitable trees during the coming spring by grafting will have ere this selected and placed the scions in a suitable place where they will keep green, but dormant, until required. The operation of inserting the scion into the stock can be carried out at any time during the spring months, provided the scion has not dried out or broken into growth. Perhaps the best time is about the middle of October, when the stock will be gorged with moving sap; on the other hand, grafting may be done at about the first bud-movement.

The rods selected for making grafting scions, when taken from the tree, should be of the preceding year's growth; usually they are about 18 in. in length and about as thick or a little thicker than a lead pencil. The scion, when ready for inserting into the bark (cut from these rods) should be about 4 in. or 5 in. long, carrying three buds. The lower end is cut wedge-shaped by making a sloping cut starting just above an opposite bud and cutting downwards. The best scions are obtained from the centre portion of the rods.

As directed in the June issue notes, if the trees to be grafted were cut down at pruning time, it will be necessary just prior to inserting the scion to make a fresh cut. The procedure is then as follows: With a sharp knife carefully trim the jagged edges of the bark caused by the saw, thus leaving a finish with a bevelled edge. There are two methods of inserting the scion. The first is to make a vertical incision about 1½ in. to 2 in. long through the bark of the stock, carefully lift the bark on one side of the cut, and press home the wedge-shaped scion between the bark and the wood of the stock, taking care that one edge of the bark of the scion comes in contact with the edge of the bark of the stock. Binding is necessary, and for this purpose raffia is recommended. The operation is completed by covering the whole with a suitable grafting wax, so as to exclude air, moisture, and all foreign matter.

The second method is to make two vertical incisions from 1½ in. to 2 in. long through the bark of the stock and about ⅜ in. wide, or just wide enough to take the full width of the scion. Press home the scion so that both its edges come in contact with the edges of the bark of the stock. This will leave a tongue of bark at the outside of the inserted scion, which must be cut off about half-way down. Bind and wax as above. This method of inserting the scion, if not quicker, is certainly neater, and the graft will callus over more quickly than with the former method.

On larger branches it is advisable to insert two or three scions with the object in view of healing over the entire wound surface as soon as possible. When this has been achieved the scions not required for building the tree may be removed.

Grafting Wax.

Wax made of the following proportions, and well pulled, will not crack and is recommended for use: Beeswax, 1 lb. to 2 lb.; resin, 4 lb.; tallow, 1 lb., or raw linseed oil, ¾ pint. Slowly melt together, stirring well to cause the ingredients to better incorporate with one another. When ready to pull, in fifteen to twenty minutes, pour into a bucket of luke-warm water. Then grease the hands to prevent the wax sticking, and pull the wax until it becomes light yellow and tough. Make into balls of convenient size, then throw them into a bucket of cold water to stiffen, and use when required. If too hard, put a lump into warm water for a few minutes and it can then soon be worked with the hands.

Some growers prefer to apply the wax hot and in liquid form. A small brush is convenient for this purpose, but the method is more wasteful of material. The wax can be applied safely a little warmer than can be borne by the hand, but should be well below boiling-point of water; it is suggested, however, to melt the wax and allow it to cool until about the consistency of thick cream before applying. Care must be taken when applying wax to see that all cavities are filled up, particularly round the scion at top of the stock. It must also be applied an inch or so below the bottom of the scion.

—J. W. Whelan, Orchard Instructor, Palmerston North.

Citrus Culture.

Where planting-work has not been completed no time should be lost in having the trees put out. Should the conditions in the spring become dry there is a certain amount of danger by delaying too long and the trees would suffer in consequence. However, so long as the soil has had thorough preparation and a fine tilth is maintained it is quite safe to plant quite late in the season. The one important point in connection with all young trees is having the soil in first-class condition, as this will enable them to commence root action with as little delay as possible. For trees to remain stagnant in the soil after planting for an indefinite period is not conducive to good results. It is necessary, therefore, that every care should be taken both in the preparation of the soil and in the planting out of the trees.

After the holes have been prepared for the reception of the trees and they are placed in position the first filling of fine soil should be made and tramped firmly. The second filling should have mixed with it a smaller quantity of blood and bone or other suitable fertilizer. This will give the young trees a stimulus and enable them to come away more rapidly when growth commences. Should they be in positions exposed to winds a strong stake should be driven in alongside each tree, by which they can be supported. It is quite impossible for young trees to become well established if they are shaken about by winds.

Cultivation work should be pushed ahead as soon as the soil conditions will allow, but on no account should it be undertaken when the soil is in a wet or sodden condition. Good cultural methods are very desirable in all orchard practice, and it is the lack of this that often causes disappointment and poor returns. All operations should be kept well in hand, and this can only be done by having a definite method by which to work.

It may be that slight damage has been caused to some of the shoots by frost. Where damage has been done, and all danger is past, these injured portions should be cut back in order that new growth may be produced.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Final Hatchings.

THE correct season for rearing chicks of any breed is now nearing its end, and therefore no time should be lost in placing the last of the eggs for this season in the incubators or under the natural mother. If the chicks hatched are to have sufficient stamina to withstand the heat of the summer, and to make satisfactory development by the time the period of high-priced eggs arrives, it is particularly important that the young stock be hatched out during the early season.

Christmas Ducklings.

Ducks should be mated now without delay, to enable eggs to be placed under the incubation process for the production of ducklings for the Christmas market. It should be remembered that ducks should be mated well in advance of the time the eggs are required for hatching purposes, or a high percentage of infertile eggs may be expected. Ducks, especially the heavier breeds, usually require to be mated much longer than fowls in order to ensure a minimum number of infertile eggs. To cater for the Christmas trade the eggs should be put down about fifteen weeks before the young birds are to be marketed. This will allow twenty-eight days for hatching (the natural time), and the remainder for rearing the birds to a marketable age. It is always a wise course, whether it be with table ducklings or poultry stock intended for the Christmas trade, to market them at least a few days before the festive season sets in. In this way, the poulterers who cater for the best trade are given an opportunity of preparing the birds for market and placing them in the freezer to await the rush.

Hatching Duck Eggs.

Ducks are not nearly so difficult to hatch and rear by artificial means as is generally supposed, provided common-sense methods of management are employed. The temperature during the period of incubation, at the level at the top of the eggs on the tray, should be 102° F. for the first week, 103° from then on to the pipping stage, and 104° when hatching. If the right degree of temperature is maintained, and the eggs are fairly fresh when set, the ducklings will commence to pip late on the twenty-sixth day, and hatch out on the twenty-eighth day. On no account should one open the incubator and attempt to help the young birds out of the shell unless they have been given their full time to hatch.

During the first week the eggs require very little cooling. In the second or third week the time allowed for cooling should be increased by degrees up to thirty minutes, and during the last week up to forty minutes or even an hour—much depending on the temperature of the incubator room. Care must be taken, however, not to allow the eggs to get chilled on cold days.

One of the worst difficulties in artificially hatching duck eggs is in getting the air cell to dry down to a desired line, a common cause of fully developed ducklings dying in the shell at pipping time. Trouble from this

cause can be prevented by spraying water at a temperature of 103° F. on the eggs, with the mouth, after the fourteenth day. Do this immediately after turning, and place the eggs back in the machine. Do not cool after spraying. Spray in the morning, and cool at night. The incubator vents should at all times be partly open, so that any excess of moisture not required by the eggs can get away. Generally speaking, no further moisture is required. The spraying of the eggs not only has the effect of increasing the size of the air cell, but also softens and weakens the membrane lining of the shell, and assists the young duckling to get out of its prison.

Ducks not laying.

A correspondent writes as follows: "We have some purebred Indian Runner ducks and they have not laid an egg for months past. They have been running in the same yard as the hens, and have been fed a mash in the morning and grain in the evening." It is a mistake to have ducks in the same yard as the hens, but this alone should not be the cause of their not laying. Probably they are not getting an ample food-supply, or if they are it may be of inferior quality. Dry grains should not be fed to ducks, and a mash at all times is to be preferred. Of course, if the birds have passed their best period of production, or if they are of the extreme show type and not bred from a laying strain, eggs other than during the natural laying season cannot be expected.

In a case such as this I would advise feeding the following mixture if the birds are to be kept under confined conditions: Two parts of pollard, one part bran, and a half part maize-meal, with 7 to 10 per cent. of meat-meal, to which, say, 25 per cent. (a quarter of the bulk) of chaffed green food such as lucerne, clover, or silver-beet may be added. The amount of meat-meal mentioned is the amount for one day, and if it is included in both the morning and evening feeds the percentage used should only be half of that stated. When ducks have unlimited range of grass paddocks, or are allowed to run, say, in an orchard, they will pick up much animal food in the form of insect life, and will thus not require the same amount of meat-meal as when kept under confined conditions. Broken sea-shell and water should be in reach of the birds at all times. Ducks are usually of a nervous temperament, and the slightest abnormal condition is apt to disturb them. Fright, caused by the presence of hedgehogs, ferrets, weasels, &c., or from the lights of motor-cars will often upset them, and this is followed by a false moult at the expense of the egg basket.

Supply of Breeding Males.

Many poultry-keepers experience disappointment in being unable to secure breeding cockerels when the latter are most required—*i.e.*, at the commencement of the breeding season. The reason is obvious; the average specialist breeder keeps only a limited number of cockerels beyond those required for his own use, and unless orders come to hand in advance of the breeding season for those available for disposal, he markets them in the ordinary way. If a stud breeder has to keep cockerels for a year, or nearly so, he cannot sell these at the moderate price which the average poultry-keeper is prepared to pay, and show a fair margin of profit.

Even when bred from the best of parents, there are usually few cockerels in proportion to the number hatched that show signs of possessing desired type and breeding power during the growing stage, while even with the most promising of these many have to be marketed for table use by reason of the natural defects developing with age, or by accidents, which will always occur. The accident factor applies particularly with strong vigorous birds, as once these commence fighting there

is no telling what damage they will do each other from a breeding standpoint. Obviously, if the cockerels have to be fed and attended for the greater part of the year, taking up houses and runs at the same time, they may easily show a loss instead of a gain, even when they are all disposed of for stud purposes. On the other hand, if no orders are forthcoming and the bulk of the birds have to be sold for table purposes, the catering for the breeding cockerel trade will certainly prove a decidedly non-paying proposition.

Another unsatisfactory feature in sending out breeding cockerels is that the purchaser often expects too much for his money. For example, orders are sometimes received for cockerels at the Wallaceville Poultry Station from people who expect the ideal breed and utility type in the one bird. The Station aims at producing stock which possess utility characters as the first essential, and takes every care to maintain desirable breed points, but at the moderate prices charged it cannot undertake to furnish exceptional specimens suitable for the show pen, few of which are to be found in the best-bred flocks.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Breeding.

NORMALLY at this time of the year there are large patches of brood in the hives. A further examination may be carried out where the beekeeper was in doubt in the preceding month as to the hive being queenless or not. The absence of brood at this season will denote a poor queen or that the hive is queenless. In either case it is advisable to unite with another hive. This should be done immediately, as a queenless hive stands in great danger of being robbed by other bees in the apiary. A ready method of uniting is by placing the weak colony over a strong one on the stand of the latter, with a sheet of newspaper between the two hive-bodies. They may be examined after a couple of days to see if things are going well, and if the paper is not bitten through it should be torn in several places. In another day or two the united colonies will be working peaceably. In the case of the weaker colony it is wise to kill the queen before uniting.

At this examination the beekeeper must keep a strict watch for symptoms of disease. If foul-brood is discovered in a mild form the colony should be marked for treatment later in the season. Should the colony be badly affected, however, it is advisable to sulphur the bees and destroy the combs. Care should be taken to remove the hive to a place of safety until it can be properly cleansed.

Overhauling the Hives.

In August a great deal of the preliminary seasonal work of the apiary may be done. Each hive should receive a good coat of paint. This will help to preserve the timber, besides giving the hives a neat appearance. The bottom-boards should be scraped clean. During the winter months there is usually an accumulation of cappings, pollen, and dead bees, and, if left, this becomes a harbour for woodlice, which are very objectionable. A simple plan is to provide a spare bottom-board. Lift the hive on to the spare one, scrape the old board, and replace the hive. Remove all top boxes, and make the bees snug and warm for brood-rearing. Clean all weeds and long grass from round the hive. Long grass keeps the hives and bottom-boards damp, and acts as a harbour for insects.

Cleansing Hives and Frames.

The beekeeper should not fail to cleanse all hives and frames that have been in contact with diseased colonies. This work may be undertaken now, and the hives and frames prepared for future use. Where there is only a small number of frames to be cleansed it is hardly worth while to attempt to save them. However, if much material has to be treated the saving effected will more than pay the beekeeper for his time and labour. There are several methods for treating hives and material, but perhaps the simplest and most effective is by the use of boiling water and caustic soda. Many beekeepers recommend the use of a painter's blow-lamp, but this is not always handy, besides which the charring of the hives is an advertisement for all time that they once contained diseased bees.

The most suitable vessel for cleaning frames is an ordinary washing-boiler. To every 8 gallons of water add 1 lb. of caustic soda, and allow to boil. The frames may be tied in bundles of six and immersed in the liquid. The caustic soda attacks the propolis and wax, and this immediately floats on top of the water. Three to five minutes' immersion will serve to cleanse each bundle of frames. Skim the refuse from the top of the water frequently, and as the solution weakens add more soda. Stack the frames in supers, and place in the sun to dry. The hive-bodies and bottom-boards may be cleansed by means of a swab. Immerse the swab in the boiling water and carefully wash the inside of the hives. Care must be taken when using caustic soda, as it is liable to burn the hands.

Arrangement of Hives.

There is no set system of arranging hives, and they may be placed according to the preference of the beekeeper. The entrances should all face the north if possible; but on no account should they face south or in a westerly direction if this can be avoided, as the cold driving winds from these quarters militate against successful brood-rearing. It is important that the hives be so placed that the beekeeper need not pass in front of the entrances when carrying on operations. Do not place the hives close together in long rows, as there is a danger of the queens entering the wrong hives and being destroyed; moreover, the plan will militate against successful manipulation, as the closely adjacent colonies will be disturbed whenever one is opened.

A good arrangement of the hives is to set them out in pairs, with at least 3 ft. between each pair. This affords the beekeeper plenty of operating room. The two hives comprising the pair may stand within a few inches of each other, leaving clearance for the roofs. The space between each two rows should be at least 6 ft., but more can be given if space is not a consideration. In order to preserve the bottom-boards the hives should be raised a few inches off the ground. Concrete blocks or old bricks make excellent supports for the hive. Each hive should have a slight cant, so that the entrance is about 1 in. lower than the back. This will prevent water from collecting on the bottom-board.

Precautions against Robbing.

A strict watch should be kept for robbing. This is most likely to occur when feeding has to be undertaken, and once started it is about the hardest thing to cure. Feed only in the evening, so that the excitement created by the supply of warm syrup will have died down before morning. Keep the entrances to all hives contracted, and see that there are no cracks through which a robber could possibly enter. Perhaps the main cause of robbing, however, is the presence in the

apiary of queenless or weak colonies. If the bees once discover a queenless hive there will be no peace until the source of trouble is removed. The inmates of such a hive will not defend their stores as will bees in a normal condition, and unless the colony is united with another it will tend to demoralize the rest of the apiary, until none but strong colonies will be safe from the depredations of the robbers.

Where a weak colony is in danger of being attacked, and where the beekeeper is satisfied that it is worth saving—that is, if he considers the queen good enough to build up a strong colony by the time the main honey-flow sets in—his best plan is to pile wet grass on the alighting-board and well up above the entrance, keeping the grass wet for a day or two, and painting any cracks in the hive with kerosene or carbolic solution. This treatment will soon settle the robbers and restore peace in the bee-yard. However, the best thing to do with weak colonies is to unite them without delay to stronger hives. Like most other troubles, though, prevention is the best thing when dealing with robbers. Do not spill any syrup near the hive, do not leave any combs lying about, and do not have any weak colonies, and you will not be troubled with robbing.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

On land inclined to be dry in summer silver-beet should be sown now outside, and New Zealand spinach in boxes for planting out later; they are of excellent quality, stand drought well, and are rarely attacked by insect pests, including the white butterfly; they are useful green vegetables for summer cropping where the conditions are difficult.

The demand for salad crops makes the celery crop of increasing importance. Plants are easily raised if the seed is sown thinly now in boxes and placed on a hotbed or even in a cold frame. By pricking the plants out later into beds or boxes good fibrous roots are obtained, which ensures good growth when planted out permanently. Where the soil is rich and moist the plants may be grown without trenches; but under dry conditions the trench facilitates watering, and as a water-loving plant celery should never be allowed to become dry. Where the conditions are naturally suitable the self-blanching varieties are generally best, especially in the warmer localities.

On sandy land by the seashore sea kale is a perennial crop that is easily grown. Such localities along the coasts of Europe are its natural home. As the crop is harvested in the spring it is of special value, since there is usually but little variety at that season. It may be grown from seed or root cuttings. Seeds may be sown now in rows 1 ft. or so apart and the plants thinned to a distance of 6 in.; they will then be ready for planting out permanently after twelve months' growth; this is done at a distance of 2 ft. between plants and 2½ ft. between the rows. Root cuttings give a quicker return; they are made from pieces of root about the thickness of a cigarette and about 4 in. or 5 in. long. It is convenient to cut the tops square across and the lower end with a slanting cut. These should be planted out now in rich ground well prepared in an open position, where the crop should produce well for five years or more. The top of the cutting should be 2 in. below the surface of the ground. A number of growths will appear from each cutting, but all should be removed except the strongest. Occasional

applications of nitrate of soda will bring the plants along strongly. The crop has a fairly wide range of adaptability, and need not be confined to such localities as those mentioned.

Established crops of asparagus will be greatly assisted by an occasional light dressing of nitrate of soda during the cutting season.

A valuable hardy crop of the simplest culture is the leek; seeds of a good strain sown now and planted out towards the end of the year in rich ground will produce a heavy crop with little trouble. In moist ground or humid localities Brussels sprouts, cauliflower, and cabbage may now be sown, also spinach and salads. Radishes and turnips take but about eight weeks to mature, and may often be grown now on land reserved for November planting.

Those who appreciate a variety of vegetables should plant salsify; its mildly flavoured, glutinous tap-roots are wholesome and easily grown from seed sown now. Other main crops which should be sown during September are broadbeans, peas, and potatoes.

Where interest is taken in herbs, seeds of coriander, caraway, angelica, dill, aniseed, summer savory, and sweet marjoram may be sown; the latter must be treated as a half-hardy annual. Cuttings, with a heel of old wood, of sage, rosemary, lavender, and thyme may be taken and rooted in a moist sandy soil. Spearmint, peppermint, tarragon, and chives may be propagated by division.

Berry Fruits.

Spraying and cultivation to keep down weeds will be the chief operations now in this section. The cultivation, however, should be done with great care to avoid disturbing the roots, as great injury is frequently done, especially at this season, by setting the cultivator too deep. Where vigour in the plants is lacking one or two moderate dressings of nitrate of soda or sulphate of ammonia would be beneficial.

Where Cape gooseberries are to be planted a piece of light rich ground should be prepared for planting out towards the end of October; and where strawberries are to be planted in autumn it will generally be advisable to trench or double-plough the ground now. Treat it generously with organic manures and plant early potatoes or other early-maturing crop, which may be lifted in time for planting the strawberries. The land should then be clean and in best condition for planting this crop which may occupy the ground for three or four years. Such thorough preparation is usually desirable for a perennial herbaceous crop of this class, as unless twitch and all bad weeds are completely eradicated before planting the results cannot be otherwise than disappointing.

Tomato Plants under Glass and for Outside Cropping.

Under glass at the present time the welfare of the tomato crop depends more than anything else on close attention to ventilation. In fine weather this should be given in early morning before the sun sets up a humid atmosphere and high temperature in the house; and the house should be closed again in the early afternoon to retain the dry warm atmosphere. Rough weather and frosty nights call for a good deal of ingenuity sometimes on the part of the operator to maintain the dry, warm, buoyant atmosphere that this crop demands; but careful attention in this respect during the changeable springtime period will go far in securing the abundant early crop that is necessary for profitable production.

Plants for outside cropping will now be in the seedling stage in the frames. When the first true leaf is out the plants will be ready for pricking off. For this a good compost is required, and sharp sand to keep it in a friable condition. Mix the ingredients well and pass through a fine sieve; place the more fibrous material in the bottom of

the box and fill up with soil; then press it down evenly, giving special attention to the corners. The surface will then be ½ in. or so below the edge of the box. Handle the young seedlings carefully by the leaves, and set them firmly about 2½ in. apart with the seedling leaves just above the surface of the ground. Give light shading if the weather is bright, and next day when the plants have straightened up water them with tepid water through a fine rose. Further supplies of warm water should only be given when the plants plainly show they require it.

Success at this stage largely depends on the soil used in the boxes; it should consist of good turf that has been stacked for twelve months so that it is in a thoroughly decayed and friable state when used. For pot plants and seedlings there is no satisfactory substitute for this material. Where small quantities are used the compost may be stored in a bin built for the purpose, otherwise large stacks are built in the open.

The young plants should be grown steadily; nothing is gained by rushing them up with high temperatures. Such conditions should be avoided by giving ventilation early in the morning during fine weather.

The Homestead Garden.

New lawns should be cut as soon as the grass is sufficiently long. For this purpose the mower should have the blades carefully adjusted and set high, as close cutting would be detrimental to the young grass. After rain, when the surface is practically dry a light roller weighing about 2 cwt. may be used with advantage. Later in the season, when the grass is well-established, a heavier roller may be used on light soils. Where the land is heavy caution is necessary in the use of the roller, as if the surface is at all wet it becomes consolidated to such an extent as to be detrimental.

When established lawns are thin and weedy this is generally due to an impoverished soil. By applying a complete fertilizer in early spring or autumn the grasses will be kept in vigorous condition and any weeds that appear are more easily dealt with. Where the land is light it is specially desirable to maintain a supply of humus, and a feature of the manurial treatment should be an application of rich compost of organic material and good loam in early spring. On a heavy soil the dressing may consist of fine sand in which fertilizers have been thoroughly mixed. If this is followed up with a few dressings at intervals of sulphate of ammonia and sulphate of iron, it will generally have the best results.

Worn patches in the lawn may now be returfed, and any hollows peeled, filled, and relayed; bumps may be treated in a somewhat similar manner. By such means a smooth turf of good colour will be obtained, and, although not obtrusive, it will become one of the finest features of the garden.

The adequate furnishing of the modern home demands flowers and pot plants. Consideration should now be given to the latter, as any repotting required may generally be done best during the month of September. If there is any doubt about the condition of the roots of a pot plant, it is readily ascertained by carefully turning it upside down and removing the pot; it may then be replaced and the plant carefully reversed without damage.

Should repotting be necessary there are a few precautions to be observed. See that the roots of the plants to be shifted are neither too wet nor too dry for the operation, and use clean pots and drainage crocks. Plant firmly, water well, and stand the plants in the shade until established again; do not water again until it is plainly necessary. The most suitable compost generally for this work is a sweet fresh loam and leaf mould with a good dash of sharp sand.

Sow hardy annuals and St. Brigid anemones. Prepare the ground for bedding plants. Make new beds of violets, and cut back newly planted roses to three or four buds.

—W. C. Hyde, Horticulturist, Wellington.

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION TO 31ST JULY, 1933.

APPENDED is a list of growers whose crops have been subject to and have passed the tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture. The list comprises those crops passed up to 31st July. Further lists will be published later.

In the June *Journal* was published a list of growers who had received provisional certificates. The acreage, percentage of foreign varieties present, and the group number representing the relative merits of lines were given in that list, to which intending purchasers should refer.

Dakota.

Burrowes, J., Mitcham.
McPhail, W. A., Mitcham.
Ryan, P. F., R.M.D., Weedon's.
Steele, J., R.M.D., Kimberley.
Tweedy, S., R.M.D., Dunsandel.
Walker, C. E., R.M.D., West Melton.

Aucklander Short Top.

Barratt, W. H., Springlands, Blenheim.
Crozier, W. J., Mitcham.
Eder, W., R.M.D., Sefton.
Gray, R., St. Andrews.
Martin, W. E., R.M.D., Kaiapoi.
McKenzie, J. R., Yaldhurst.
Oakley, W., R.M.D., Halkett.
Petrie, J., Jun., Swannanoa.
Rangiora High School, Rangiora.
Redmond, C., R.M.D., Kimberley.
Rich, A. J., R.M.D., Kaiapoi.
Robinson, R. G., Box 4, Papanui. (Line B.)
Roper, P. F., R.M.D., Halkett.
Roper, R. S., R.M.D., Halkett.
Simpson, F. F., Morven.
Smith, E. A., R.M.D., Springston.
Westaway, R., R.M.D., Courtenay.

Arran Chief.

Bannatyne, Mrs. E., Waikouaiti.
Borstal Institute, Invercargill.
Knowler, H., Te Waewae.
Robinson, R. G., Box 4, Papanui.
Smith, A. L., Mosgiel, Otago.
Teschner, C. A., Chatton Road, Gore.

Aucklander Tall Top.

Cross, H. E., Sandy Knolls.
Frazer Bros., Southbrook, Rangiora.
Frost, C. H., P.O., Balcairn.
Guy Bros., R.M.D., Rangiora.
Steele, J., R.M.D., Darfield.
Watkins, E. R., Springbank, Rangiora.

Arran Banner.

Burrowes, J., Mitcham.
Craig, G. H., Mosgiel.
Crozier, W. J., Mitcham.
McNae, F., R.M.D., Courtenay.
Wilson, C. H., Lorneville, Invercargill.
Wright, L. T., Annat.

King Edward.

Burgess, D., West Plains, Invercargill.
Knowler, H., Te Waewae.
Martyn, F., Seaward Downs.

Up to Date.

Smyth, H., care of W. Munro, Mount Hutt R.M.D.
Steele, J., R.M.D., Kimberley.

Epicure.

McLachlan, G., R.M.D., Southbridge.
Tweedy, S., R.M.D., Dunsandel.
Shellock, W., R.M.D., Te Pirita.

Majestic.

Cross, H. E., Sandy Knolls.
Crozier, W. J., Mitcham.
Robinson, R. G., Box 4, Papanui.

Early Rose.

Burns, R. A. C., Mead Settlement, Rakaia.

Jersey Bennes.

Burgess, D., West Plains, Invercargill.
Stevenson, G., Weston, Oamaru.

Kerr's Pink.

Shellock, W., R.M.D., Te Pirita.

Early Regent Bolter.

Oakley, W., R M.D., Halkett.

Arran Victory.

Smyth, H., care of W. Munro, Mount Hutt R.M.D.

—*Fields Division.*

FERTILIZER IMPORTATIONS: JUNE QUARTER.

FOLLOWING are particulars of importations of fertilizers into New Zealand for the quarter ended 30th June, 1933 :—

Nitrate of Soda : Chile, 244 tons. *Basic slag :* United Kingdom, 9,456 tons ; Belgium, 4,701 tons. *Phosphatic guano* (soft phosphates) : Seychelles, 3,043 tons ; New Caledonia, 1,408 tons. *Rock phosphates :* Nauru and Ocean Islands, 35,551 tons ; Tuamotu Archipelago, 7,022 tons. *Other phosphates :* United Kingdom, 300 tons ; Belgium, 1,027 tons ; Netherlands, 250 tons. *Kainit :* Germany, 90 tons ; Poland, 185 tons. *Muriate of potash :* France, 62 tons ; Germany, 22 tons. *Sulphate of potash :* France, 70 tons ; Germany, 78 tons. *Other potash fertilizers :* France, 150 tons ; Germany, 298 tons. *Sulphate of ammonia :* United Kingdom, 485 tons.

WEATHER RECORDS: JULY, 1933.

Dominion Meteorological Office.

Rainfall.—The distribution of rainfall during the month was rather patchy. On the whole, the average was slightly exceeded and there were some isolated very high totals. On the other hand, large areas received less than usual. North Auckland, North Taranaki, South Wellington, and the Bay of Plenty and central districts of the North Island registered an excess, while most of the remainder experienced a shortage. In the South Island, western districts and the interior had much more than normal, but eastern and far southern districts much less. The rain on the west coast was made up largely of a very few but very heavy falls.

Temperatures did not generally differ greatly from the average for July. In eastern districts from Canterbury northwards the persistent southerly winds and lack of sunshine were responsible for low day temperatures, and the mean also was consequently somewhat below normal. The remainder of the country enjoyed more genial conditions. There were no severe cold snaps, and frosts were rather less frequent than usual.

Sunshine.—Though sunshine was below normal everywhere except in western and far southern districts of the South Island, it was only in eastern districts that the deficits were large. Nelson recorded 143·4 hours, while Hokitika, on the wet west coast, in spite of 21·73 in. of rain, came a close second with 142·9 hours. Wellington City, with 77 hours, occupied a position at the bottom of the list.

Pressure Systems.—The weather in July was generally similar to that in June so far as the type of storm system was concerned. Most of the storms were of cyclonic form, and there was a persistent tendency for high pressures over the southern portion of the Dominion. Several very intense anticyclones were experienced, barometers rising on the 27th to over 30·6 in. at a number of places. There were only three depressions of the westerly type, and of these the only one that affected the weather greatly was that which passed on the 9th. A low-pressure trough extended a long way northwards from this depression and general rains resulted, especially in the North Island. Snow fell on the ranges of the South Island.

The first of the cyclones passed the northern extremity of the North Island on the 3rd. There were heavy rains in the far North as it passed, and south-easterly gales followed it.

Between the 14th and 17th a complex depression crossed the South Island. Practically all districts recorded heavy rain, many of the falls being of exceptional severity. Floods occurred in Taranaki, Westland, and the Mackenzie Country in western South Canterbury. The fall of the 14th, which in many cases exceeded 2 in., was quite an unusual one for the district last mentioned. Snow fell in the same area on several days and was widespread on the ranges generally.

A third cyclone, which crossed the tip of the Auckland Peninsula on the 22nd, also caused general rains. Southerly gales blew after the centre had passed, and there was further snow on the ranges.

Stormy weather, with north-east or northerly gales, prevailed during the last two days of the month, while a cyclone, which had caused heavy floods in New South Wales, was advancing across the Tasman Sea.

RAINFALLS FOR JULY, 1933, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	7·37	15	1·35	5·63
Russell	18·02	17	4·16	5·30
Whangarei	7·59	19	1·76	7·28
Auckland	5·03	12	1·31	5·07
Hamilton	4·72	10	1·04	5·17
Rotorua	5·08	10	1·51	5·05
Kawhia	4·70	10	0·80	6·17
New Plymouth	7·46	12	2·53	6·46
Riversdale, Inglewood	11·80	12	4·89	10·21
Whangamomona	8·13	8	2·32	7·48
Hawera	2·86	9	1·41	4·45
Tairua	9·34	15	3·84	6·32
Tauranga	6·76	10	1·44	5·23
Maraehako Station, Opotiki ..	7·58	12	1·96	4·58
Gisborne	3·76	18	0·89	5·07
Taupo	4·11	10	1·23	3·91
Napier	4·34	16	1·54	3·82
Hastings	2·88	17	0·92	3·69
Whakarara Station, Kereru ..	4·41	16	1·02	..
Taihape	2·42	13	0·79	3·04
Masterton	4·11	17	1·33	4·24
Patea	2·18	10	1·54	4·33
Wanganui	2·99	9	1·69	3·40
Foxton	2·92	7	1·58	3·24
Wellington	6·00	19	1·59	4·71
South Island.				
Westport	10·02	15	3·15	8·30
Greymouth	12·02	15	3·68	8·03
Hokitika	21·73	15	6·04	8·87
Ross	24·04	13	7·60	9·46
Arthur's Pass	19·88	10	5·63	10·33
Okuru	12·34	9	4·95	10·77
Collingwood	9·77	12	3·03	9·88
Nelson	4·21	9	1·70	3·52
Spring Creek	2·39	9	0·58	3·55
Hanmer Springs	3·17	14	0·81	4·44
Highfield, Waiau	2·34	9	0·53	3·37
Gore Bay	1·91	12	0·48	2·87
Christchurch	1·55	12	0·39	2·69
Timaru	1·55	7	0·73	1·90
Lambrook Station, Fairlie ..	2·47	9	1·26	2·65
Benmore Station, Clearburn ..	3·13	11	2·01	1·79
Oamaru	2·44	11	0·85	1·74
Queenstown	2·11	5	0·83	2·06
Clyde	1·05	6	0·38	0·92
Dunedin	2·21	11	0·54	3·01
Wendon	1·20	4	0·50	1·81
Gore	1·36	9	0·70	1·96
Invercargill	1·93	14	0·75	3·28
Puysegur Point	2·96	11	0·99	6·19
Half-moon Bay	1·62	16	0·33	4·41

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

BEST TIME FOR DEHORNING COWS.

R. S. SMITH, Tutira:—

Would you please advise me the best time for dehorning dairy cows?

The Live-stock Division:—

The dehorning of a dairy herd may be carried out on a cool day in the spring or autumn. As many cows will be heavy in calf at the present time it is advisable to wait until after calving has been completed. Any time between calving and the commencement of the next breeding season a suitable day may be selected. It is advisable to carry out the operation before the summer, as in hot weather the wounds are liable to become contaminated and possibly fly-blown.

DAIRY INDUSTRY REGULATIONS.

FURTHER amendments to the General Regulations under the Dairy Industry Act, 1908, were gazetted on 27th July, 1933, and came into force as from that date. Briefly, the amendments provide as follows:—

(1) Milk for butter and cheese making to be graded not less than three times in each testing period. (The previous regulations required daily grading.)

(2) Provision is made for alternative methods of payment where milk grading is not carried out daily.

(3) Dairy factory managers to record the temperature and humidity of cheese curing rooms daily.

(4) Waxing of cheese is prohibited except by written authority of the Director of the Dairy Division, who must be satisfied that an importer of cheese into the United Kingdom has made a request that such cheese be waxed for export.

STOCK SLAUGHTERED, 1932-33.

FOLLOWING are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1933:—

Stock.	Abattoirs.	Meat-export Slaughter-houses.	Bacon-factories.	Ordinary Slaughter-houses.	Totals 1932-33.	Totals 1931-32.
Cattle ..	140,083	197,218	..	56,307	393,608	322,942
Calves ..	56,275	541,668	..	1,392	599,335	593,029
Sheep ..	765,151	2,561,306	..	243,141	3,569,598	4,464,894
Lambs ..	220,758	9,463,846	..	33,981	9,718,585	8,689,196
Swine ..	131,328	347,998	30,583	22,214	532,123	430,914

—*Live-stock Division.*

Japanese Millet with Rape.—In the past season a farmer near Blenheim sowed 5 lb. of Japanese millet per acre with his rape. This mixture provided a good forage crop, and the millet was closely fed down by the stock. A similar mixture proved very satisfactory at the Moumahaki Experimental Farm in 1924.